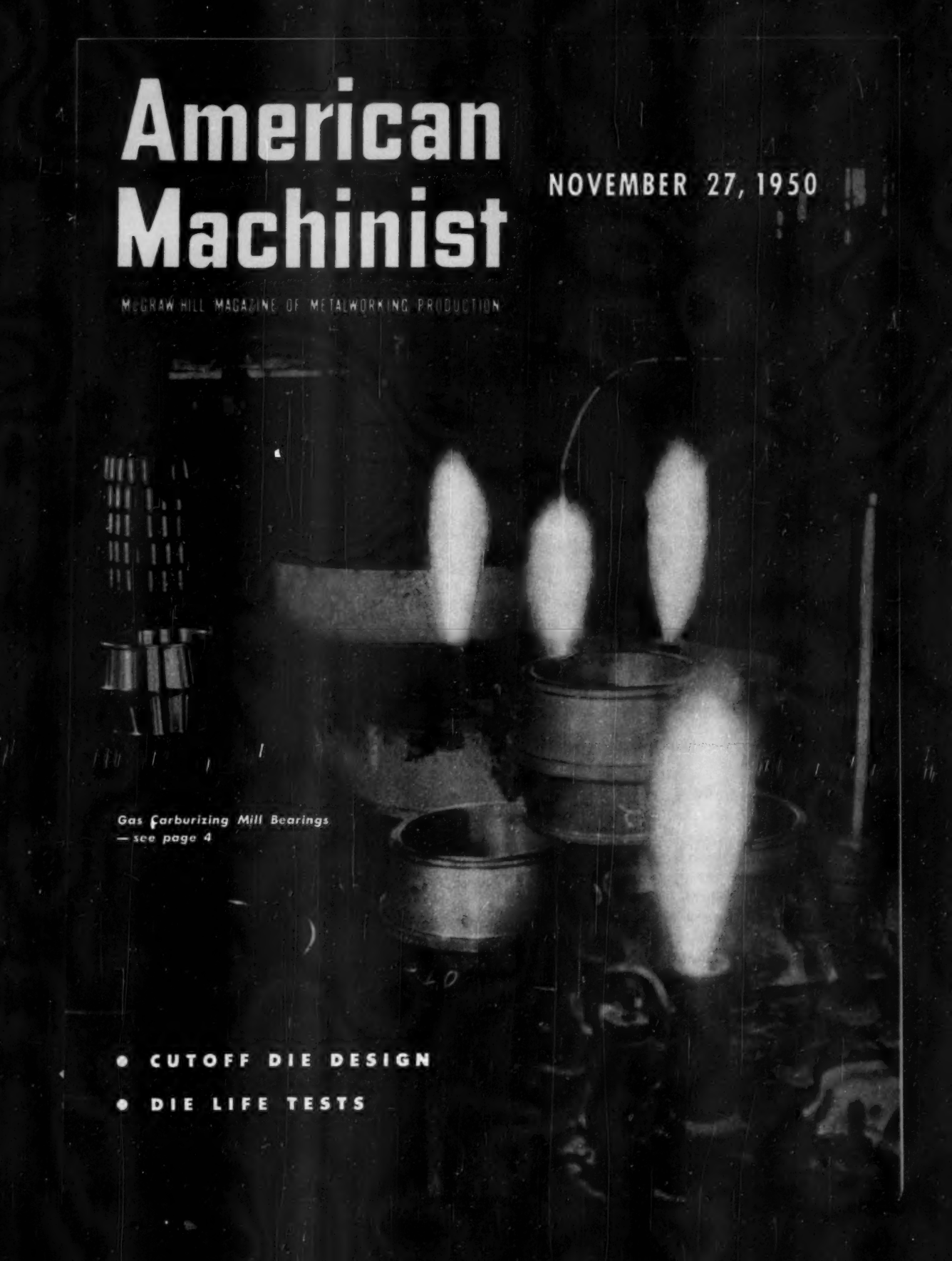
American Machinist

NOVEMBER 27, 1950

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION



Gas Carburizing Mill Bearings
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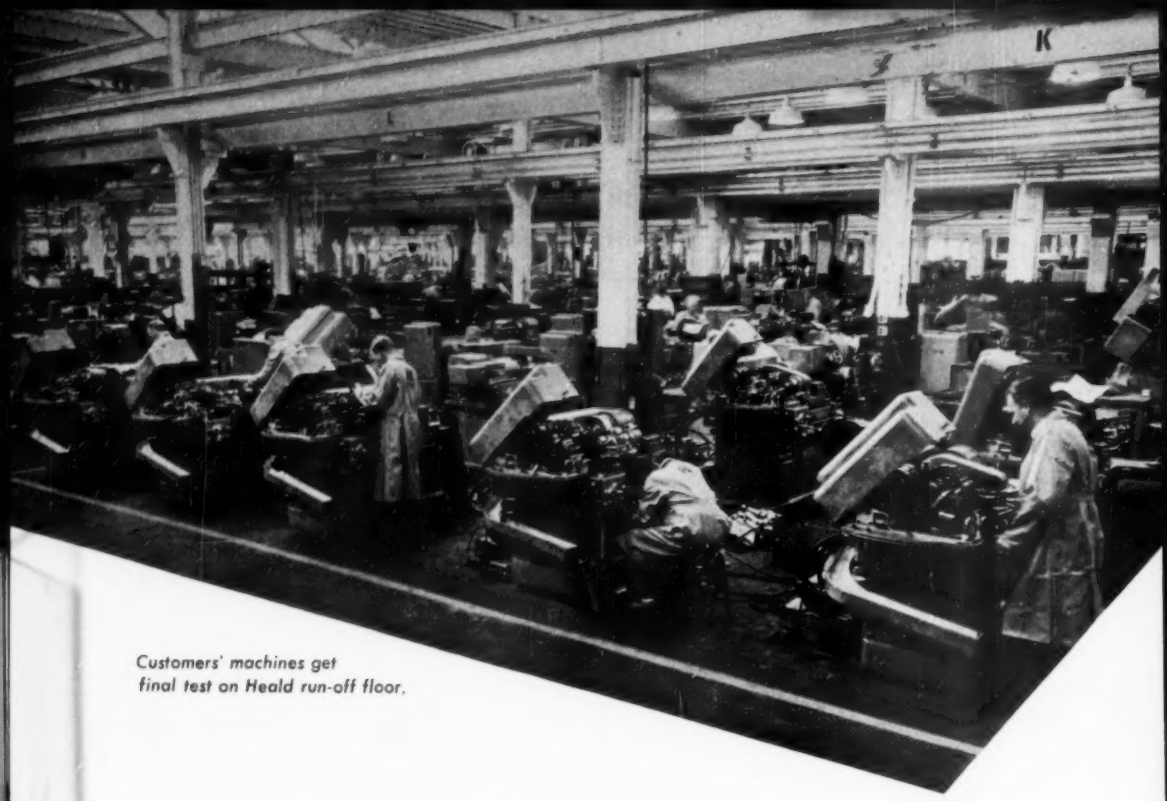
- **CUTOFF DIE DESIGN**
- **DIE LIFE TESTS**



Customers' machines get final test on Heald run-off floor.

starting point*

for a thousand production lines

* Yes—precision production lines the world over have had their beginning *right here!*

For this is the Heald run-off floor, where *every machine* is put through its paces before shipment—turning out exactly the same parts it will handle on the customer's production line, at the same high production rates and the same close tolerances for size, finish, accuracy and precision.

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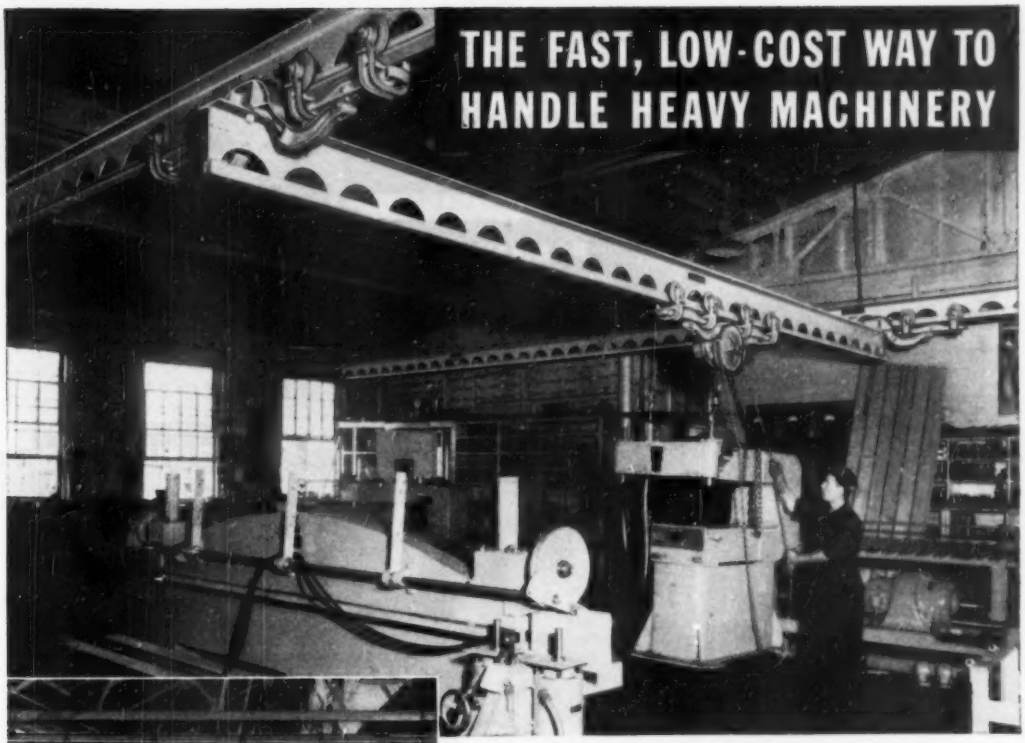

Hand-propelled crane with chain hoist handling heavy steel frame for veneer machine.

Hand-propelled crane with electric push-button operated hoist moving a diesel engine.

IF HARD back-breaking work is required on the part of several men to move a machine in your plant, you should seriously consider Cleveland Tramrail cranes.

A heavy engine or machine-tool can be quickly and safely moved by one or two men with a smooth running Cleveland Tramrail crane. Shipping boxes or crates are easily packed. Work that requires *hours* can often be done in *minutes* with an overhead crane.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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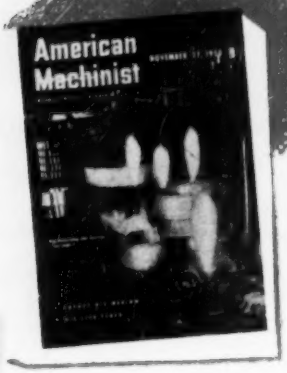


Chips and Quips

Largest Carburizing Dept. . . . Timken Roller Bearing Company, at its Canton, Ohio, plant, has the world's largest carburizing department. These 48-in. natural-gas furnaces, largest of their type, are used for carburizing large mill bearings like those between the two nearest units. The flames are, of course, from the burning of spent gas after carbon has been absorbed from it by bearing parts. For more information on carburizing, see our current series by T. A. Frischman; the third instalment is in this issue.

Positioner . . . Proving out on our promise to bring you worthwhile data on armament production, we give you in this issue a description of a universal positioner tool developed at Glenn L. Martin. It permits attachment of finished "working" surfaces (locating surfaces) to the essentially rough supporting structure of a big aircraft fixture. Total fixture-setup time is slashed 20%, machining time on the locating spots as much as half.

Machinability . . . For the past year and more, we have been following progress of studies of machinability of various materials at Ford Motor Co. under supervision of R. T. Hurley, for the Air Forces. When Mr. Hurley went to Curtiss-Wright as president, he took the contract along, but Ford continued the work on materials that go into an automobile. We've planned a report on the Ford work several times, rescheduled it each time because it was not quite ready for release. Mr. Hurley's work has just been released, however, and Ford has cooperated by allowing us to publish that information at the same time. Thus we bring you here an extract tailored for your use. This issue carries a Special Report of 16 pages on widely used materials.

Die Life . . . Lamination dies cost money. When steel and when carbide? Westinghouse made a study; we give you the answers here. Heat-treating and hardness data are given, plus compositions, for a variety of tool materials . . . We also have another Paquin "here's how," this time on cutoff dies . . . Along the same line, too, is a single-page story on crimping dies to fasten identifying strips on wire leads.

Dept. 200 . . . When a company is willing to spend enough on indirect labor, operators can spend their time doing what they're paid to do—keeping their machines running. Crompton & Knowles Loom Works was willing to do just that. As a result, machines are now running 88% of the time instead of 55%. Output is up 60%.

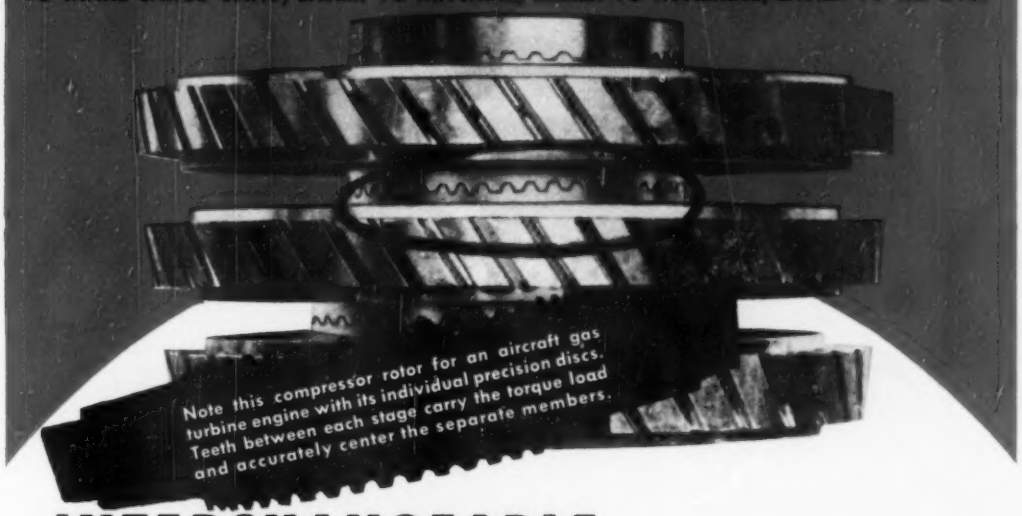
Friction . . . Friction is man's greatest help—and his worst enemy. To bring you up to date, we've extracted the key points from a recent study by Franklin Institute. It shows new theory on friction and its effect on Metalworking.

Plastic Problem . . . One of our associate editors, aghast at tiling prices, devoted a week of vacation to home modernization—installing plastic tile in a bathroom. He returned with wild tales of his initial difficulties. We presented him with a marked copy of "How to Machine Plastics" (*AM*, June 26). He admits it answers all his questions and would have saved days if he'd read it.

Coming . . . Further data on tool & die steels will be included in our Dec. 11 Special Report. In that issue there'll also be a description of some tricky progressive dies, tooling for die casting, articles on forming pipe coils, power spinning, thread stripping, the Buick crankcase line, a fixture for induction heating, and conversion of a drillpress for small-lot production. The cover shows a multi-purpose profiler.

DEPARTMENT 200 . . . Where machine tools make textile-machine parts 85% of the time, all the time, is the subject covered by author Oscar V. Payne in this issue. Mr. Payne's first patent was issued in 1915 on a thread-locking device, thought up after working on propeller development. Something of a "gun crank" to this day, he holds the original patents on the devastating "Tommy gun", which he developed with General Thompson, after whom the gun is named. He worked for Reed & Prince Mfg. Co. as chief engineer, then moved on to Crompton & Knowles Loom Works to do development engineering and inventing. He has since become works manager. He pioneered home-workshop power tools, and has a most complete shop. During the war he was in charge of the manufacture of shells, radar, aircraft parts, and tank equipment in his plant, also served on Navy Secretary Knox's Manpower Survey Committee.

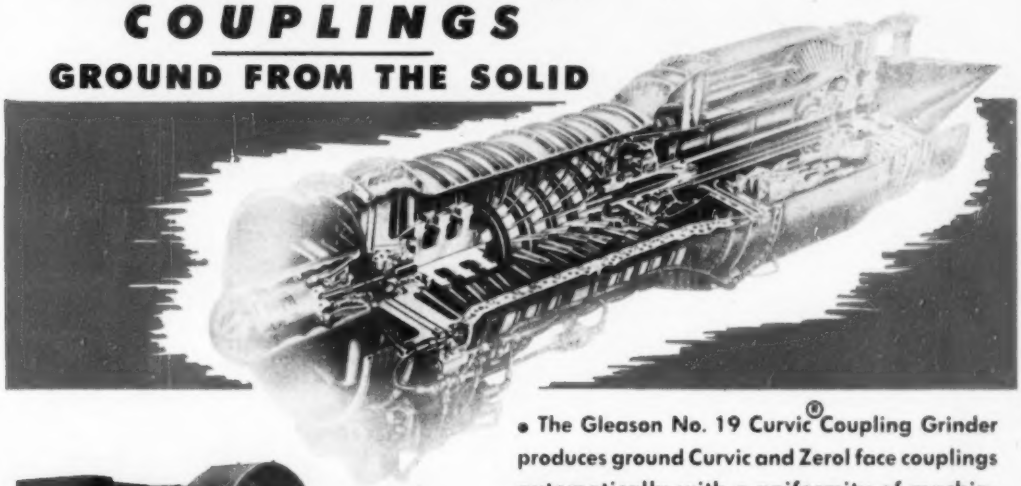
TO MAKE LARGE UNITS, EASIER TO MACHINE, EASIER TO ASSEMBLE, EASIER TO REPLACE



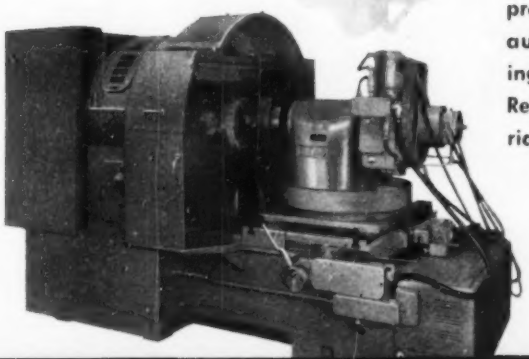
Note this compressor rotor for an aircraft gas turbine engine with its individual precision discs. Teeth between each stage carry the torque load and accurately center the separate members.

INTERCHANGEABLE COUPLINGS

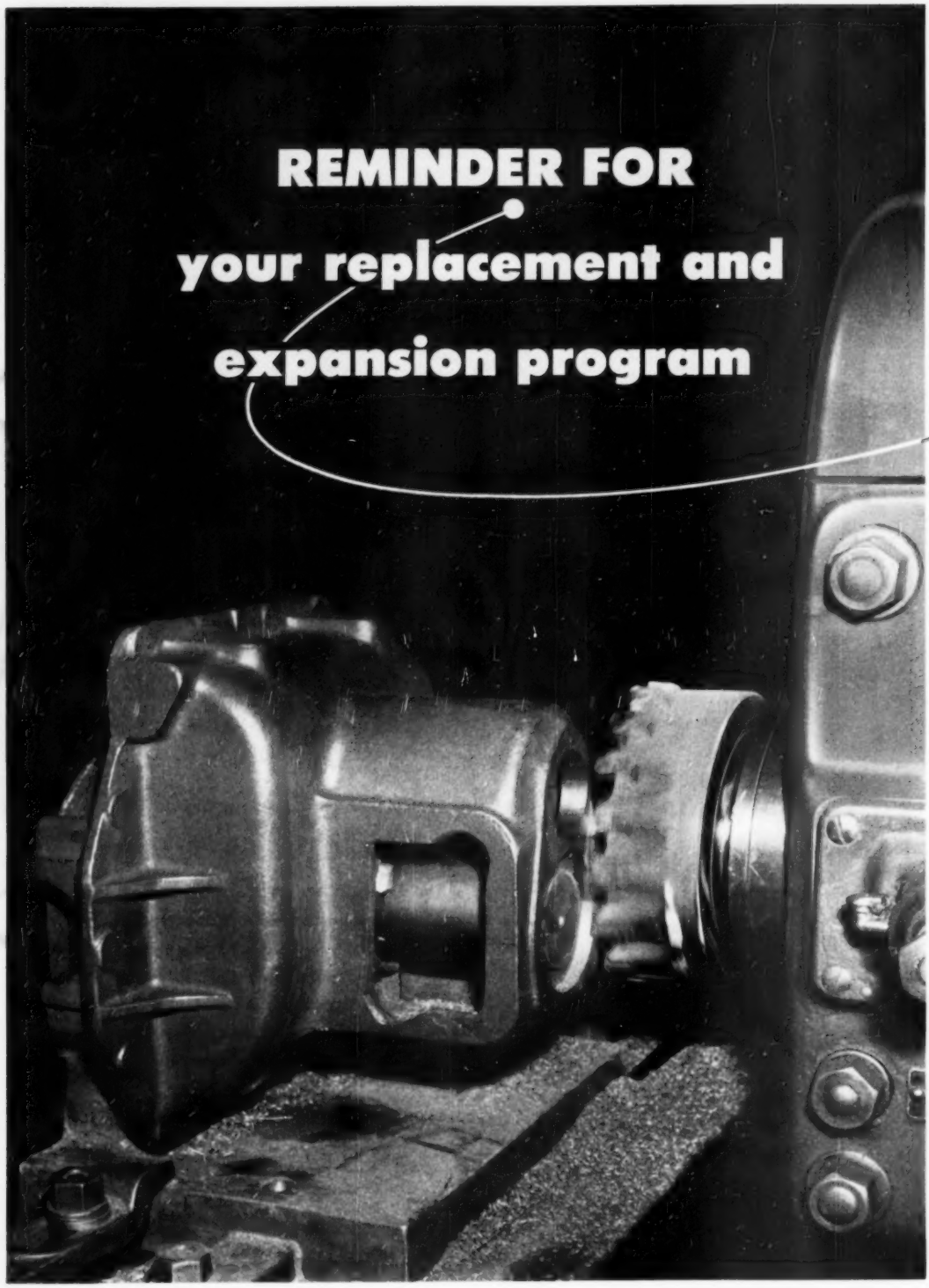
GROUND FROM THE SOLID



• The Gleason No. 19 Curvic® Coupling Grinder produces ground Curvic and Zerol face couplings automatically with a uniformity of machining which makes each part interchangeable. Replacement costs of large units can be materially reduced by using built-up units employing the principle of the permanent couplings.



Builders of Bevel Gear Machinery for Over 85 Years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your replacement and
expansion program

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30 : 4 : 1

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● CINCINNATI No. 2 Cutter and Tool Grinder. Catalog No. M-1618-2.

● CINCINNATI Monoset Cutter and Tool Grinder. Catalog No. M-1591-1.

Thirty milling machines use a lot of cutters. To keep them working efficiently, you will need at least four No. 2 Cutter Grinders and one Monoset. The 30:4:1 ratio is for the average shop using both sintered carbide and high speed steel cutters. For high speed steel cutters alone, the ratio can be as high as 40:4:1; for sintered carbide cutters alone, it can be about 20:4:1. These figures may serve as a reminder that your production schedules will bog down without an adequate supply of accurately sharpened cutters. Of course, the best cutter grinders you can buy are CINCINNATIs. Reasons why are numerous.

CINCINNATI No. 2 Cutter and Tool Grinder—Control levers at two front and two rear operating positions . . . fixed operating height for all cutters sharpened with standard equipment . . . cartridge type antifriction spindle mount, lubricated for life, easily replaced . . . antifriction ways for table slide, replaceable if worn after years of service.

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Check the ratio today of your milling machines versus cutter grinders. It may save you headaches later on. And remember, if you have only a few milling machines, you still need a No. 2 Cutter Grinder . . . you can assign other work to it. Now, while you're thinking about cutter grinders, ask for the Cincinnati literature. Brief specifications in Sweet's.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

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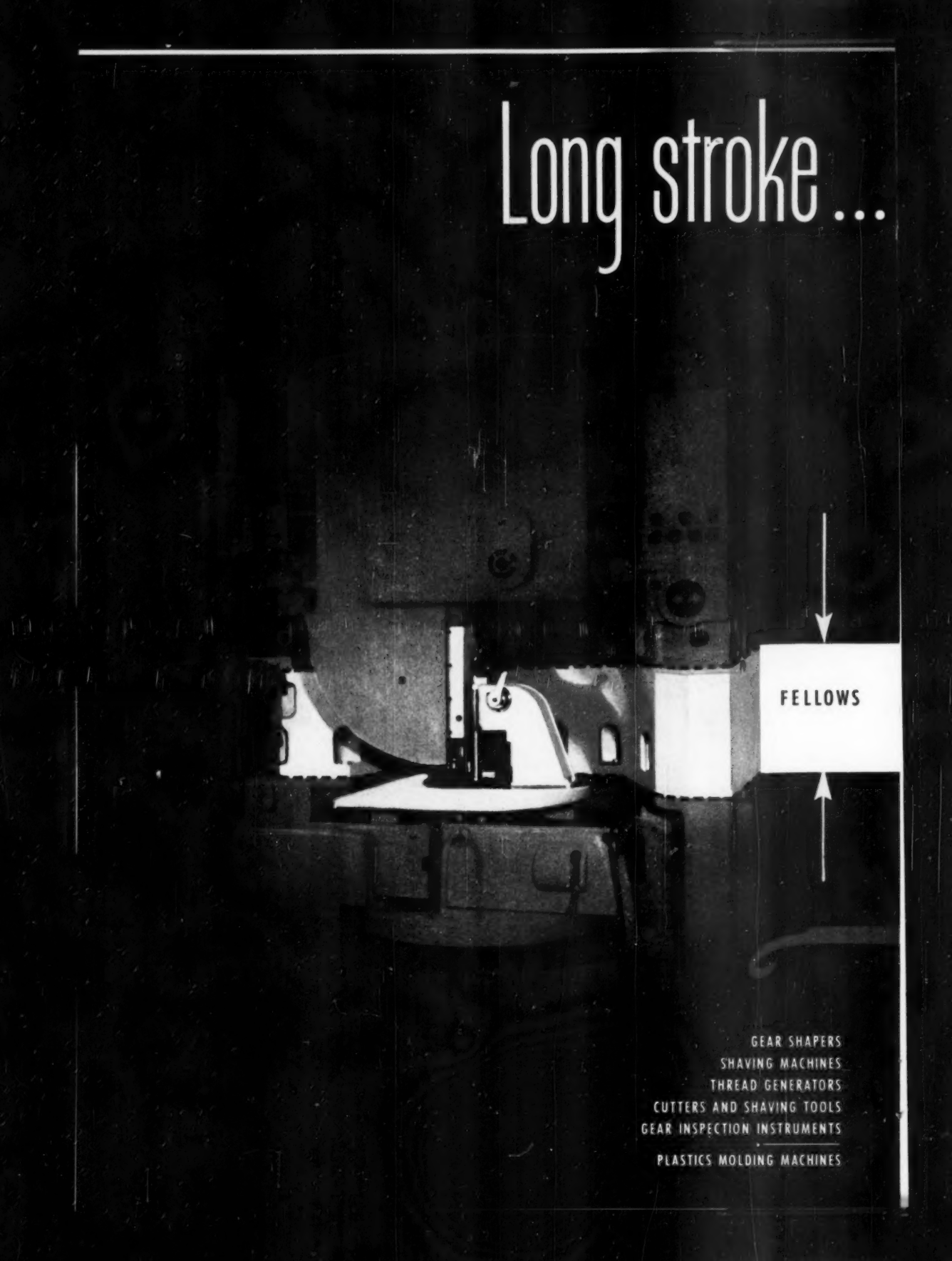


GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS

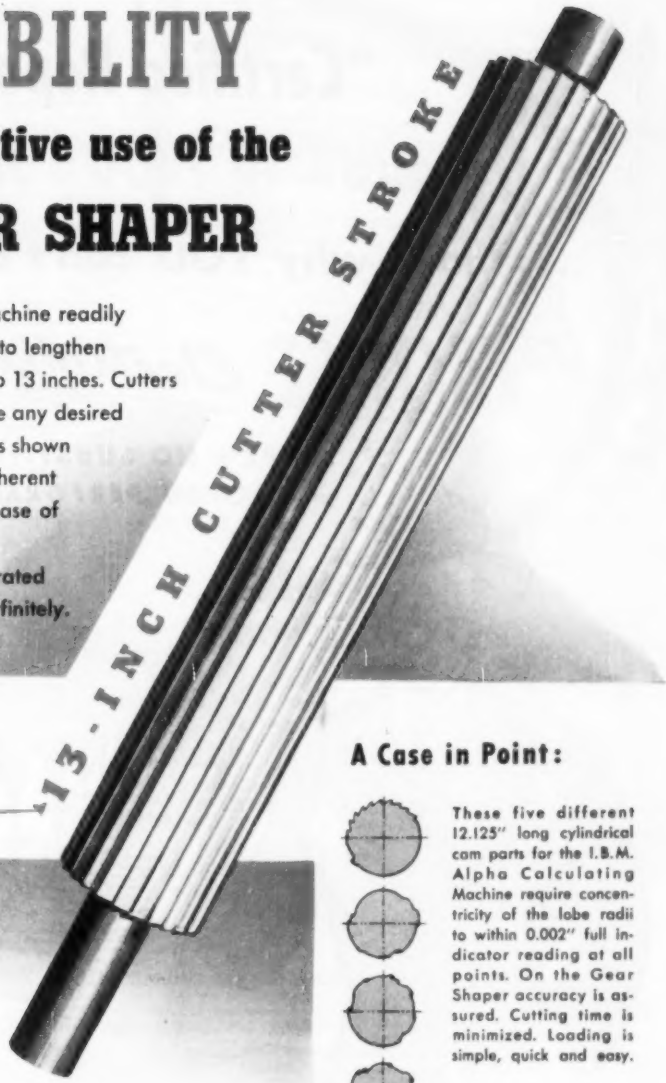
PLASTICS MOLDING MACHINES

...ADAPTABILITY

invites imaginative use of the

No. 36 GEAR SHAPER

Basic design is such that this machine readily accommodates a raised section to lengthen the normal 6-inch cutter stroke to 13 inches. Cutters can then be provided to produce any desired contour, such as on the slim parts shown here. The controlled precision inherent in the Fellows Cutter, and the ease of sharpening, makes possible the economical production of generated shapes to close tolerances, indefinitely.



DESIGN MODIFICATION PROVIDES

A Case in Point:

These five different 12.125" long cylindrical cam parts for the I.B.M. Alpha Calculating Machine require concentricity of the lobe radii to within 0.002" full indicator reading at all points. On the Gear Shaper accuracy is assured. Cutting time is minimized. Loading is simple, quick and easy.

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...that's why YOU can't afford NOT to use
"MORSE *Electrolized* TOOLS"

THERE'S NO SUBSTITUTE FOR PROVEN PERFORMANCE

*A Certified Report from A User of MORSE *Electrolized* TOOLS:

DRILLS:

"Good deal of excitement here today. Shop Superintendent was getting results with Electrolized Step Drills that were almost unbelievable. Drilling heat-treated aluminum, the best that had been done was 2 to 4 hours before the drill had to be re-sharpened.

"So far, the Electrolized Drill has gone 2 days and 2 nights — and shows no sign of getting dull. Operators work on the incentive plan, and they want Morse Electrolized Tools. This is a production job, and the ordering directions are being changed to MORSE ELECTROLIZED."

Certified A. L. Carr
General Sales Manager
Morse Twist Drill & Machine Co.
New Bedford, Massachusetts

*A Certified Report from A User of MORSE *Electrolized* TOOLS:

REAMERS:

"In automobile spring steel, reaming 4 spring-leaves at one time, we had been using up approximately 3 reamers a week.

"Then, changing to Morse Electrolized Structural Reamers, Style 1701, it was found that only one reamer was good for an entire week's production."

Certified A. L. Carr
General Sales Manager
Morse Twist Drill & Machine Co.
New Bedford, Massachusetts

*A Certified Report from A User of MORSE *Electrolized* TOOLS:

TAPS:

"During the past few months, tests have been made at this plant using 7/16"—20 Morse Electrolized Taps for tapping blind holes approximately 1/2" deep in 430 F corrosion-resistant steel, on a 6-spindle automatic screw machine.

"These tests indicate that the Morse Electrolized finish on the tap gives us considerably longer tap life. Also, it has been observed that the cleaner threads, which have been obtained, are attributable to the Morse Electrolized finish."

Certified A. L. Carr
General Sales Manager
Morse Twist Drill & Machine Co.
New Bedford, Massachusetts

*A Certified Report from A User of MORSE *Electrolized* TOOLS:

END MILLS:

"This job requires 1/4" special double end mills to cut cored slots, going through scale, cutting cast iron to a depth of 3/4". 20 plain end mills were used per shift, and were nicked so badly that they couldn't be reground.

"With Electrolized End Mills, only 2 per shift were used, and we are able to get 3 grinds from each mill."

Certified A. L. Carr
General Sales Manager
Morse Twist Drill & Machine Co.
New Bedford, Massachusetts

*NAMES WILL BE SUPPLIED, on request, for any or all of these amazing testimonials which keep coming by the hundreds, witnessing the greatest success story ever written in cutting tools . . . the story of MORSE ELECTROLIZED!

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NEW BEDFORD, MASSACHUSETTS, U.S.A.

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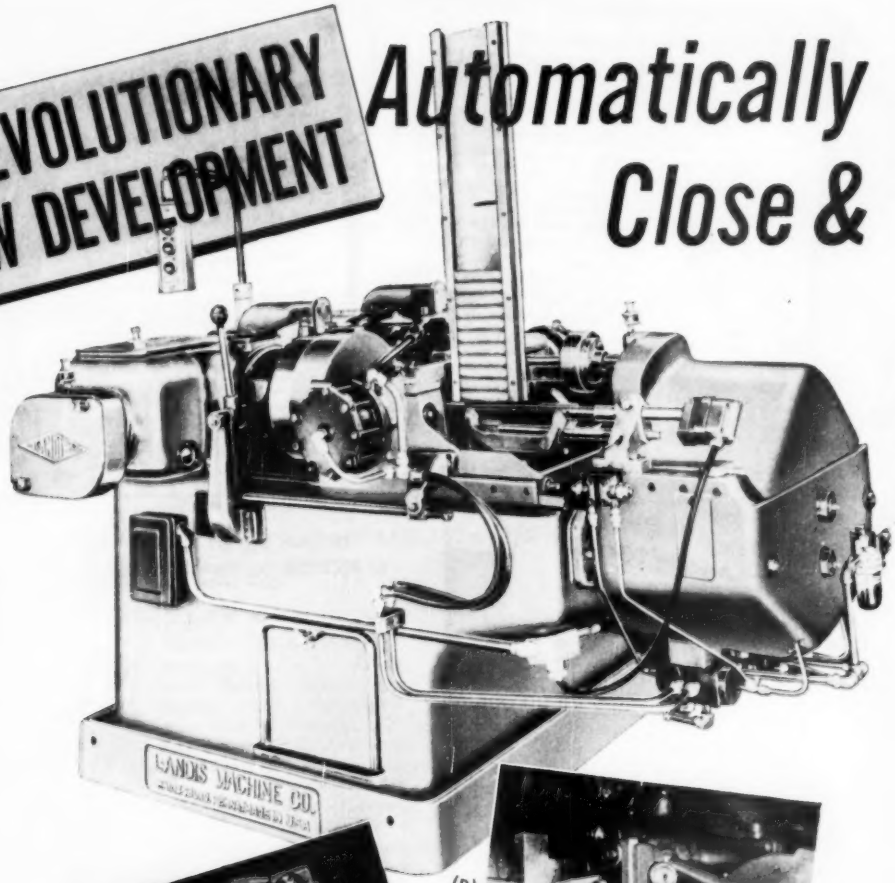
Automatically Close &



The LANDIS Machine

Threads, Reams & Chamfers Short Nipples On Both Ends

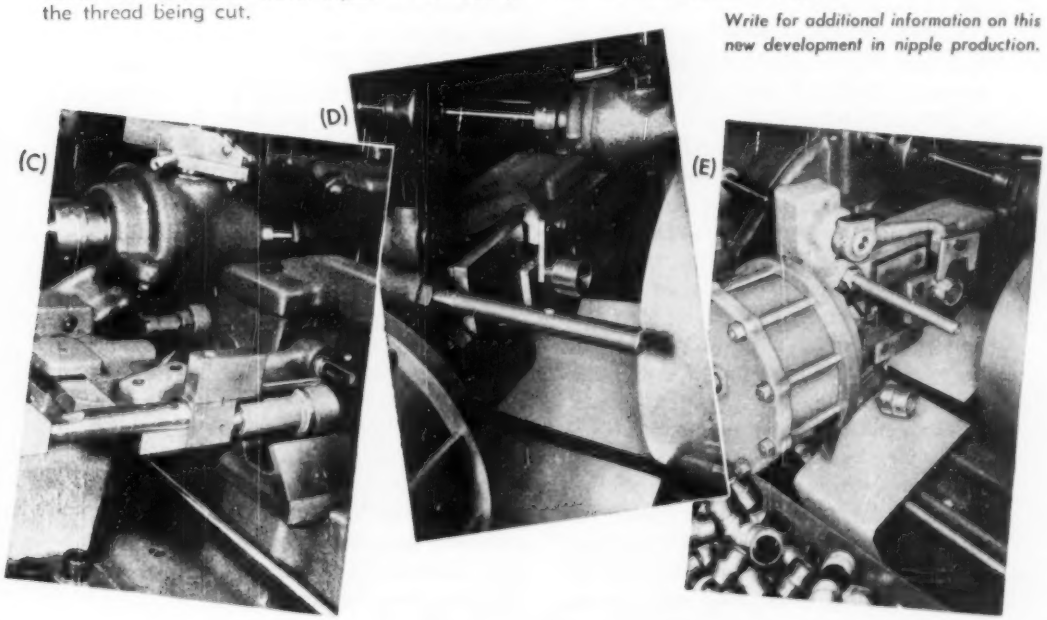
The new LANDIS Automatic Close Nipple Machine allows mass production of commercial standard close, short, and special short nipples without manual handling during the production cycle. A single operator can supervise two or three machines, depending on the nipple length, for he must only fill the magazines with blanks and remove the finished nipples when ejected.

The production cycle begins when the blanks are released automatically from the magazine on the left-hand carriage, and gripped automatically by the air-operated vise. The left-hand carriage then advances to the thread-starting position and assumes a feed rate of travel equal to the lead of the thread being cut.

At the completion of the threading, and simultaneous reaming and chamfering operations on one end of the blank, the die head and vise open and the carriage returns to loading position, leaving the semi-finished nipple in position for transfer to the right-hand carriage. Mechanical fingers remove the semi-finished nipple, turn it end-for-end (A), and place it in position on the work-rest bar of the right-hand carriage (B).

The semi-finished nipple is then gripped automatically, the operations performed on the unfinished end (C), and ejected when finished (D & E). Simultaneously another blank has begun the cycle on the left-hand carriage.

Write for additional information on this new development in nipple production.



COMPANY LANDIS **WAYNESBORO PENNSYLVANIA**

It Takes More Than Good Spindle Bearings for Precision Grinding Results

Fine finishes, close tolerances, fast sparkout, high output, dependable operation —all the signs of real precision grinding performance call for more than just good spindle bearings. At least, we at Landis Tool have found that true after building precision grinders for over 50 years. In LANDIS TOOL grinders *the combination of spindle bearings and wheel spindle* produces the performance benefits so frequently claimed for the bearing alone.

If you look at spindle bearings, you will find that a number of good types are in use today. Practically all of them, if properly lubricated, will give you minimum trouble. The Landis Tool Microsphere Bearing, however, has one outstanding feature that contributes greatly to the superior performance of LANDIS TOOL precision grinders. That feature is an extremely small running clearance between bearing and spindle. This is made possible by the combination of spindle and bearing design.

Production men understand the importance of short sparkout time to fast grinding. How many know, though, that if the bearing clearance is close, the sparkout time will be cut to a minimum, and the wheel will respond more quickly and accurately to the feed mechanism. With its close clearance, the MICROSPHERE Bearing delivers this necessary short sparkout time.

Grinding performance also depends on the wheel spindle which the bearings support. When stock removal is heavy, you subject the spindle to bending stresses. To keep spindle deflection to a minimum, the LANDIS TOOL wheel spindle is increased in diameter between bearings. This provides 1½ to 2 times more sectional area between bearings than at the bearings!

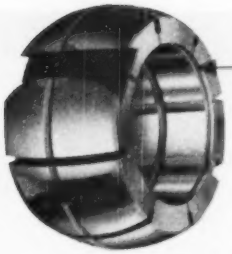
The LANDIS TOOL extra diameter spindle provides a rigidity of spindle not found in other grinders. In terms of performance, this means a fine finish, free from spindle flutter.

The *combination* of the close operating clearance of the MICROSPHERE Bearing and the rigidity of the increased diameter spindle delivers fine finishes, close tolerances and maximum output.

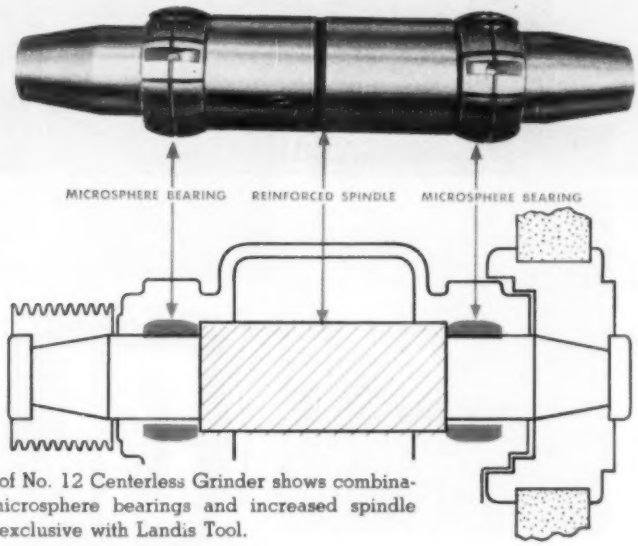
Two unusual applications illustrated on the opposite page demonstrate the importance of the LANDIS TOOL combination of Microsphere Bearing and extra diameter spindle.

For more information on why it takes more than good spindle bearings for precision grinding results, we will be glad to send you a copy of the booklet "Microsphere Bearings."

LANDIS TOOL COMPANY, WAYNESBORO, PENNA., U.S.A.

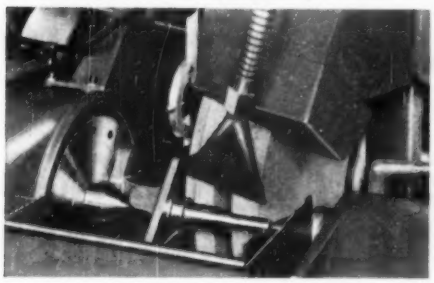


One Piece Microsphere Bearing
Steel Construction—Babbitt Lining
Used Only On Landis Tool Precision Grinders

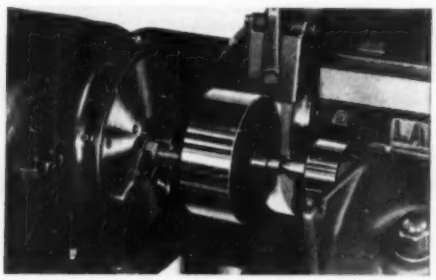


Cutaway of No. 12 Centerless Grinder shows combination of microsphere bearings and increased spindle diameter exclusive with Landis Tool.

Unusual Applications Demonstrate Importance of Microsphere Bearing and Reinforced Spindle Construction



Two spaced wheels mounted at end of spindle with wheel base set at 30° angle.

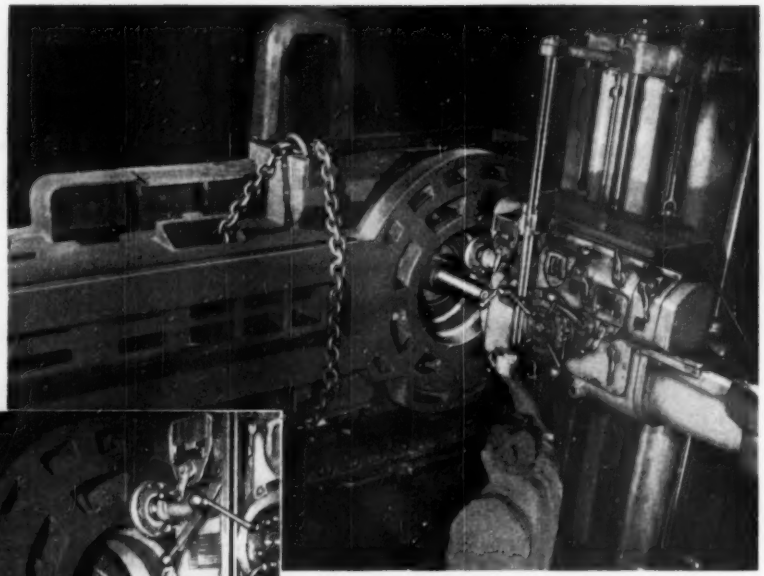


Grinding a foil finishing roll to a 2 micro-inch finish on a Landis Tool 12" Universal.

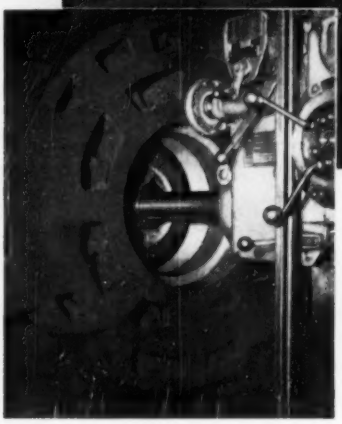
LANDIS TOOL

Precision Grinders

Many machine tool builders now depend upon their G. & L. horizontal boring machines to perform boring operations such as this. Accuracy of the G. & L. and simplicity of work set-up solves many difficult problems.



Close up of the boring head showing the bearing seat bores for a rotating machine table. Three bores are easily held to .001" using this table type G. & L. machine.

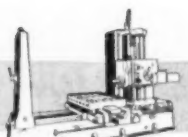


easily holds tolerances to .001"

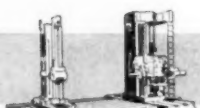
ON THESE TWO IMPORTANT MACHINE TOOL COMPONENTS

GIDDINGS & LEWIS
FOND DU LAC

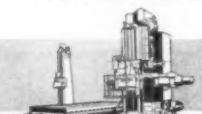
G&L HYPRO



G. & L. Table Type Horizontal Boring Machine

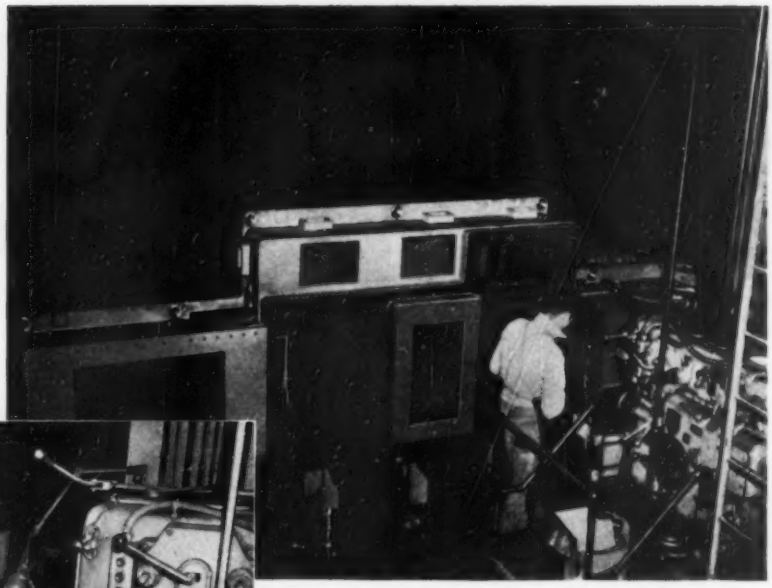


G. & L. Floor Type Horizontal Boring Machine

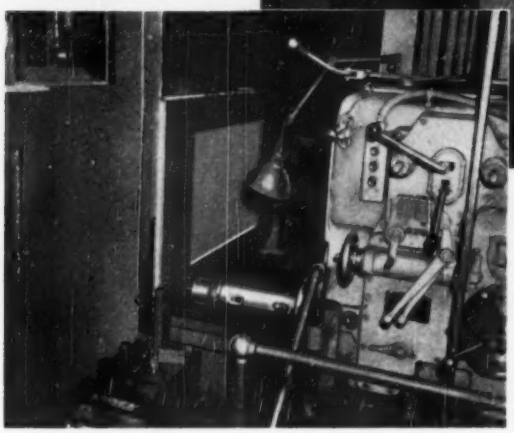


G. & L. Planer Type Horizontal Boring Machine

This G. & L. Floor Type Machine is used by a leading machine tool manufacturer to perform precision operations on a large way machine base where overall machining accuracy must be closely held.



Boring a series of locating pin holes for mounting unit heads on a way machine. These holes must be parallel within .001" of the base sides and provide the same tolerance for unit location both horizontally and vertically.



1 Machine Scales and Vernier Used to Locate Precision Bearing Bores

Another typical example of the built-in accuracy of G. & L. machines is the precision boring of a large machine tool base on which a machine table will be mounted. Three finish bores, 22.500" — 20.000" — 20.000", are made with a special boring head and held to a tolerance of .001". Machine scales and verniers are used to locate these bores. The dependability of G. & L. horizontal boring machines in producing important machine tool components makes it possible to produce more accurate units at less cost.

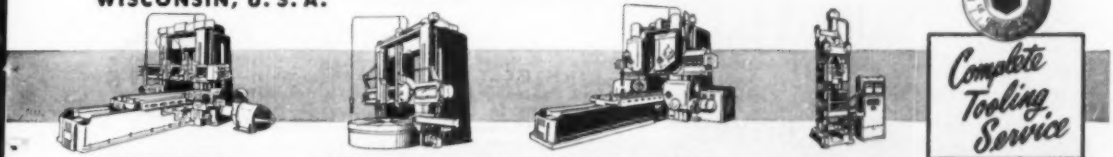
2 Manufacturers Rely on the Accuracy of Giddings & Lewis Machines to Bore Vital Locating Pin Holes

Rigid accuracy requirements are readily maintained with a G. & L. floor type horizontal boring machine in boring locating pin holes on a way machine base. Two way units are mounted on the opposing wings of the base and pin holes must be held parallel to ±.001" with the side of the strip for unit location vertically as well as horizontally. In addition to the precision boring on the wing, other machining operations are performed in the same work setting insuring accurate relationship of the machined surfaces, bores, drilled and tapped holes, etc., for final assembly.

If you wish to lower your production costs and meet urgent delivery demands, G. & L. engineers will gladly study your machining problems and submit recommendations on simpler methods using horizontal boring, drilling and milling machines.

MACHINE TOOL COMPANY

WISCONSIN, U. S. A.



Cincinnati Hypro Double Housing Planer

Cincinnati Hypro Vertical Boring and Turning Mill

Cincinnati Hypro Planer Type Milling Machine

G. & L. Vertical Plastics Injection Press

To solve your Speed Reduction problems

reach for this

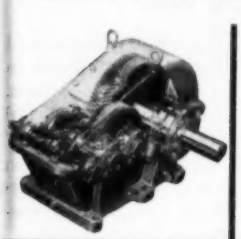
At your service to supplement the engineering data in these three books is the Link-Belt application engineer who will welcome the opportunity to discuss with you your power transmission problems.

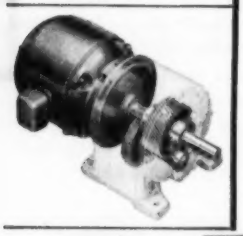
Book 2419—describes Link-Belt Herringbone Gear Drives in single, double and triple reduction.

Book 2247—describes Link-Belt Gearmotors, Motogears and Helical Gear Drives, packaged power drives with ratings of from 1 to 75 h.p.

Book 2324—describes Link-Belt single, double or helical Worm Gear Drives with horizontal or vertical output shafts.

or this





All of these books are available to you. Write your nearest Link-Belt office.

or this

LINK-BELT enclosed gear drives

LINK-BELT COMPANY Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Johannesburg. Offices in Principal Cities. 12.132

Are you buying machine tools for a competitor?

WHEN ANY COMPANY buys *new* machine tools to replace *old* ones, it doesn't do so just to spend money. You can be sure its management has carefully figured out that these new machines are going to pay for themselves—and usually in short order.

They have satisfied themselves that they will get increased production—that this increased production will cut costs—and they expect to use these lower costs to get more business for themselves.

TAKE EXAMPLES SUCH AS THESE:

COMPANY A, replaced 3 old machines with 2 new Warner & Swasey Turret Lathes and cut machine time 27%.

COMPANY B bought a new Warner & Swasey No. 5 Spindle Automatic to turn an important precision job being done on old machines. *Result:* Production increased 5 to 10 times, labor costs reduced 93%. Capital investment reduced 66%. Power costs reduced 70%.

COMPANY C installed a new Warner & Swasey 1-AC Single Spindle Automatic and produced as many pieces in a single hour as had formerly been produced in 6 hours on an old single spindle machine.

COMPANY D bought a new Warner & Swasey 5-Spindle Automatic, saving 50% on operators and setup man's time, besides thousands of dollars in cutting tool reconditioning and replacement by elimination of secondary operations.

If any of those companies are among your competitors, bidding against you for machining work or selling a similar product, unless you, too, are using up-to-date machines, they can undersell you.

Their increased business will be at your expense. *Then it is actually you who are paying for the new tools bought by your competitor.*

WARNER & SWASEY SELLS ONE THING . . . INCREASED PRODUCTION

WARNER & SWASEY Machine Tools *Cleveland*

TURRET LATHES, MULTIPLE & SINGLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

Simplify

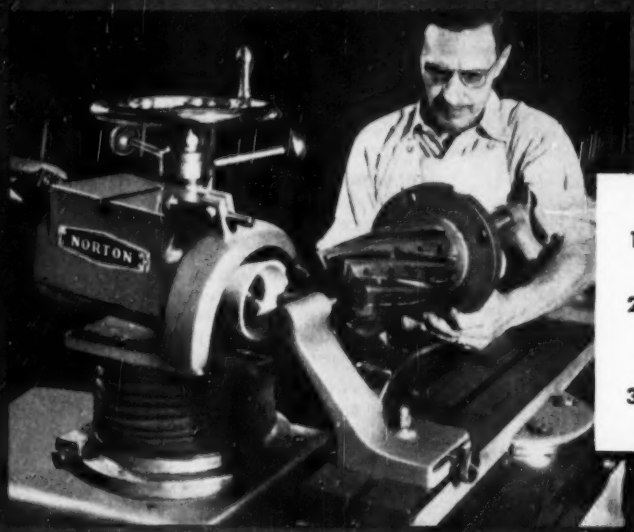
FACE MILLING CUTTER

1 Tilt Wheel Head up for desired clearance angle

2 Mount finger rest on universal work head and level tooth of cutter

3 Grind face milling cutter

TWO TYPICAL SETUPS MADE EASIER BY THE NORTON TILTING WHEEL HEAD



PLANER MILLING CUTTER

1 Tilt Wheel Head down for desired clearance angle

2 Mount finger on column and bring work to center height

3 Grind 5 x 10″ planer milling cutter

NORTON

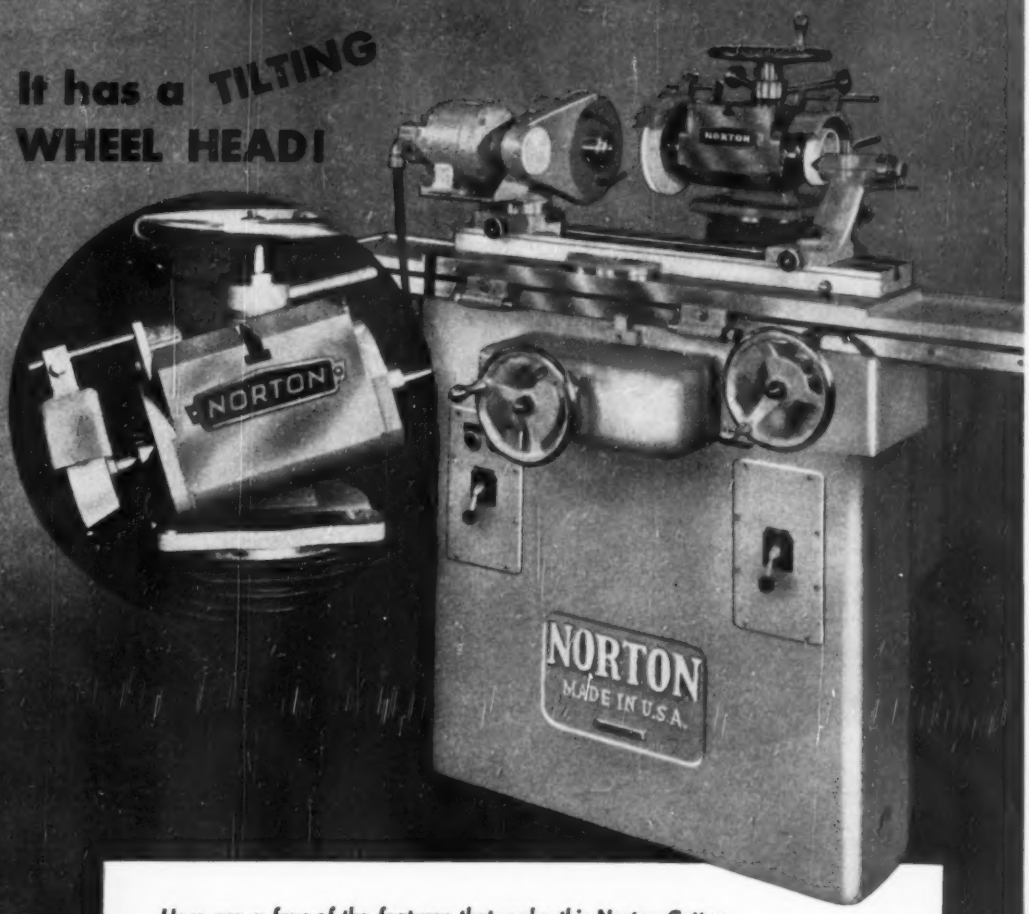
GRINDERS and LAPPERS

Making better products to make other products better

your cutter and tool grinding

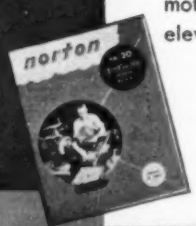
with the Norton No. 20 Cutter and Tool Grinder

It has a TILTING WHEEL HEAD!



Here are a few of the features that make this Norton Cutter and Tool Grinder easier to set up, easier and faster to operate:

Greater length of table traverse • Greater wheel slide travel • Integral motor spindle—1 h.p. • TILTING WHEEL HEAD • Centrally located column elevating hand wheel • Wheel slide graduated dials easily read from any position • Automatically lubricated table ways • Electric equipment to Machine Tool Builders' Standards • Wheel spindle reversing switch (optional) for carbide grinding

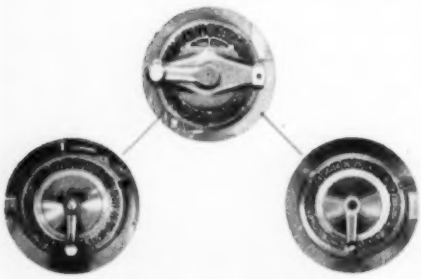


Norton No. 20 Cutter and Tool Grinder Catalog on request—no obligation.

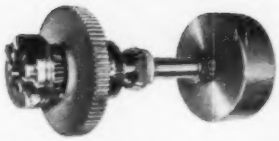
NORTON COMPANY, WORCESTER 6, MASS. • New York • Chicago • Detroit • Cleveland • Hartford • Distributors in All Principal Cities

GREATER VERSATILITY

A new line of Knee-Type Milling Machines KEARNEY & TRECKER MILWAUKEE **CK's**



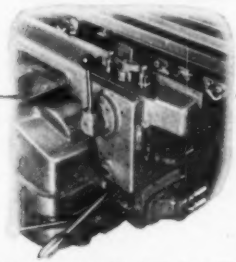
Kearney & Trecker's new **CK** milling machines are designed for the most effective use of modern cutting tools. Their wide ranges of speeds and feeds are closely suited to nearly all general purpose milling applications on most kinds of ferrous and non-ferrous metals and their alloys. On all **CK** machines you can select from 24 spindle speeds ranging from 15 to 1500 rpm on No. 2 and 3 size machines — and 13 to 1300 rpm on No. 4, 5 and 6 sizes. For quiet, effortless speed changing there's Kearney & Trecker's new automatic Protecto-mesh shift which eliminates gear clashing. All **CK** machines are equipped with the extra-wide feed range, 3/8" to 90" per minute, with separate motor drive for all feed and rapid traverse movements.



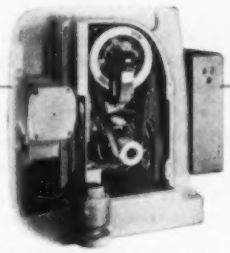
GREATER CUTTING EFFICIENCY — Added momentum of spindle-mounted flywheel assures longer cutter life and greater efficiency, through smoother, more positive drive — a key to most efficient use of modern cutting tools. Spindle rigidly supported by Kearney-& Trecker's original 3-bearing design.

GREATER ADAPTABILITY — No. 60 Heavy Duty drive flange on Nos. 4, 5 and 6 machines enables use of heavy duty arbors with flange drive for large single or multiple cutter setups; or bolting large face-milling cutters directly to spindle nose. Average setups use standard arbors with No. 50 spindle drive.

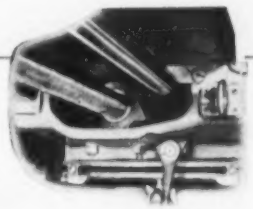
NON-GLARE RAPID-SET DIALS—You'll avoid costly errors in reading and setting these new micrometer dials. They're vapor blasted to give you a satin surface with high contrast markings. They're easy and quick to set and provide positive lock at every setting.



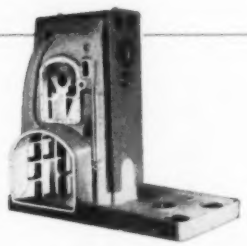
GREATER PRODUCTION AND GREATER OPERATING CONVENIENCE—Production men will like Mono-Lever Control because it reduces idle cutter time, shortens floor-to-floor cycle time on both long and short run lots. Operators will like it because it makes faster, simpler, less fatiguing work for them.



GREATER HORSEPOWER — where you need it. That's what you get with new CK independent motor drives for spindle and for feed and rapid traverse. Depending on machine size (Nos. 2, 3, 4, 5 or 6), machines range from 10 to 25 hp for spindle drive and 3 to 5 hp for feed and rapid traverse.



SMOOTHER FEED PERFORMANCE — with a new design 2" diam. heavy-duty, table feed screw that affords greater bearing contact and runs through an extra-long table feed nut. These new CK machines are equipped with a backlash eliminator for more effective climb milling, more accuracy and longer screw life.



GREATER RIGIDITY — Yes, these new CK columns are the most rigid milling machine columns we've ever designed! They give you 1000 pounds more metal scientifically distributed in heavier ribbing, box section, sponson construction . . . to effectively absorb vibration from heaviest cutting loads.

Kearney & Trecker's new CK Line is designed to meet every demand of present-day milling operations . . . making CK machines more accurate, and MORE PRODUCTIVE for you. Contact your nearest Kearney & Trecker representative or write direct to obtain complete specifications of these fine new machines. See how they easily replace obsolete machines at substantial savings to you. Kearney & Trecker Corp., 6784 West National Avenue, Milwaukee 14, Wisconsin.

Replacement of obsolete machine tools is an investment that makes Dollars and Sense.

Cut your Tool Costs with
P&W
LONG-LIFE
END MILLS
Every type, every kind in a complete range of sizes stocked for your convenience at Factory and Branch Offices listed below.
The special surface treatment given P&W End Mills results in maximum wear life.
Pratt & Whitney
Division Niles-Bement-Pond Company
WEST HARTFORD 1, CONNECTICUT
It Pays to Buy
END MILLS
on a Performance Basis
Branch Offices and Stock

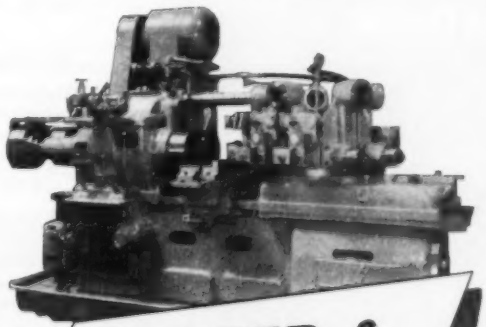
POTTER & JOHNSTON 5D - 2 Spindle - 9" AUTOMATIC

PRODUCES ONE PRECISION-MACHINED FORGING

with every turret cycle

Costs are lowered substantially when work of this calibre is set up on a two spindle machine. This job, and countless others like it, *belongs* on the P&J 5D-2 Spindle-9" Power-Flex Automatic. The first series of operations (heavy lines in drawing) are performed on the rear spindle, and the second series of operations on the front spindle. Result: one completely precision-machined part finished with every automatic cycle of the turret. Note the double tooling on each turret face in view at left. The only manual attention is for loading, transferring the work from rear to front spindle, and unloading.

This way, floor-to-floor times are greatly reduced. Labor costs are profitably divided as one operator easily handles two or more machines. Considerable savings are also effected in floor space and power consumption. P&J Tooling recommendations and time estimates based on your own sample parts or prints are gladly furnished upon request.



POTTER & JOHNSTON CO.
PAWTUCKET, R. I.
subsidiary of PRATT & WHITNEY
Division Niles-Bement-Pond Company

P&J 50 YEARS' EXPERIENCE IN TOOLING FOR
Precision + Productivity + Economy

SWISS *PRECISION CRAFTSMANSHIP* SWISS *DEPENDABILITY ACCURACY*

UNDER THE HAUSER ROOF is the greatest selection of SWISS precision machine tools available from any one source in the United States.

HAUSER

Jig Borers—Six types ranging in table size from 4" x 4" to 24½" x 29½"

Jig Grinders—Two Types, table sizes 14½" x 9½" and 12½" x 22"

Optical Measuring Machines—Profile and workshop microscopes with magnification up to 100 X

Profile Projector—Magnification up to 100 X, screen size 18½" x 22"

Hardness Testers—Test range, 1 Kg. to 200 Kg.

Pivot Polishing Machines—Six types ranging in work diameters from .028" to 1"

SAFAG

Automatic Wheel and Pinion Cutting Machines—Four types ranging in work diameters from .012" to 3.93"

Automatic Form Cutter Milling Machines—Work diameters, .02" to 2"

Automatic Cutter Backing Off Machines—Work diameters, .22" to 1.38"

AGATHON

Various Types of High Precision Die Sets—Minimum space between columns, 14"

SCHAUBLIN

Toolmakers Lathes, Turret Lathes, Repetition Lathes, Lead Screw Lathes—Six different types with swings from 5½" to 9-7/16"

Milling Machines—Five different types, working surface of table ranging from 4-23/32" x 16½" to 10" x 43-5/16". In-direction of spindle—All angles in all directions

Sensitive Drilling and Tapping Machines—Five types, capacities from ¼" to 5/32"

Automatic Drilling and Tapping Machines Spring Collets—Any form and dimension—U. S. Standards

HAUSER Type 5 JIG BORER

NEW BIGGER GUARANTEED ACCURACY OF SLIDE LOCATIONS .0002"

This newest addition to the HAUSER line of SWISS precision Jig Borers has everything that its smaller counterparts have *plus larger capacity.*

MAXIMUM DRILLING CAPACITY 1⅜" MAXIMUM BORING CAPACITY 9"

Working surface of table 29½ x 24½	Maximum distance spindle to table 28½"
Longitudinal travel of table slide 28"	Maximum distance between columns 35½"
Transverse travel of boring 20"	Diameter of circular table 20"
Vertical travel of boring spindle 7"	Diameter of tilting circular table 12¼"

For the full story of how this machine meets the growing demands of quantity production write for complete literature

TORNOS

Swiss Automatic Screw Machines—Various types ranging in capacity from 5/32" to 1-3/16"

Cam Making Machinery

LAMBERT

Semi-Automatic Gear Generating Machines—Three types ranging in capacity from ¼" to 8" in diameter

Automatic Thread Cutting Machines—Capacities from .012" to 5/16" in diameter

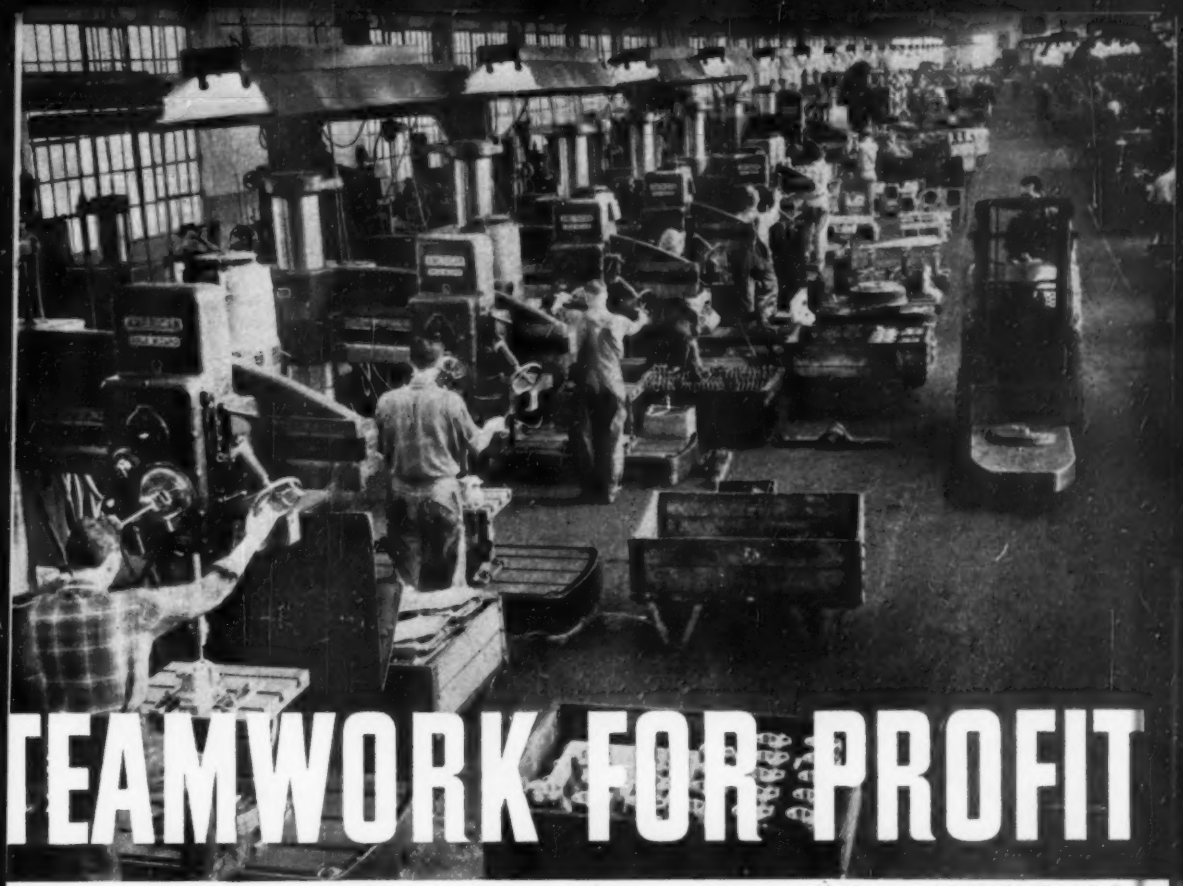
Factory Service and Replacement Parts Available at All Times

HAUSER

MACHINE TOOL CORP.

MANHASSET · NEW YORK

HAUSER-NEW YORK



TEAMWORK FOR PROFIT

Courtesy of Fairbanks, Morse & Co.

Quality Tools produce a Quality Product

Fairbanks, Morse & Co., one of the world's leading manufacturers of Electrical Equipment and Diesel Engines, uses scores of "American" Hole Wizard Radial Drills to produce quality at a profit.

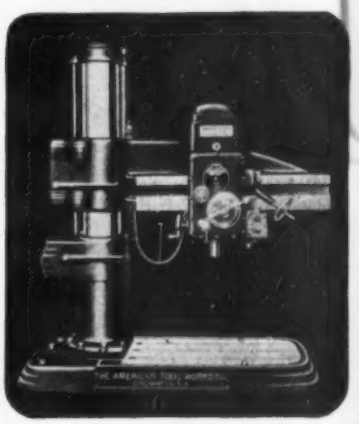
The smooth operation and easy handling of "American" Radials give them front rank recognition amongst users as dependable producers of accurate and finely finished work.

The directly connected, head mounted motor guarantees maximum power at the spindle.

Finger-tip and direct-reading controls insure speedy manipulation for greater work production.

Anti-friction mounting of head on arm and convenient location of all operating levers mean less operator fatigue and more work at day's end.

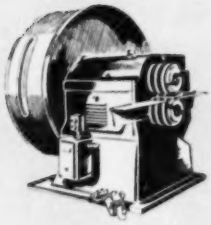
For quality work at a profit your best bet is "AMERICAN".



THE AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U. S. A.

Lathes and Radial Drills

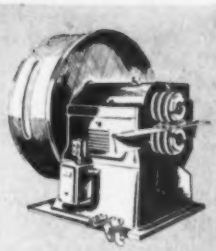


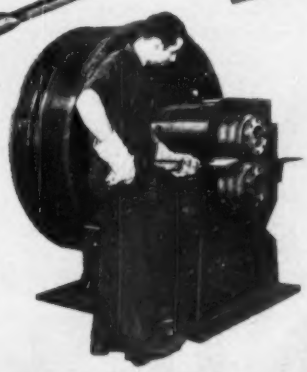
Reducerolling's really rolling along...

Typical REDUCEROLLED blanks shown on these pages indicate the extent to which this simple forging technique has been accepted by forgemen.

In a new approach to forge-shop cost-reduction, the rugged, versatile REDUCEROLL pre-forms blanks *quickly* for finish-forging on the same heat!

PREPARING FORGING BLANKS!





No. 4 REDUCEROLL

As important as buying the "best" machine is the engineering assistance and on-the-job service which the machine's builder provides.

NATIONAL engineers and service experts continue to be available—*on a cost-free basis, for the entire life of your NATIONAL equipment*—to assist you with any forging problem.

Whatever you need—die design, production procedures, maintenance, new development—NATIONAL'S long experience is "on call," yours for the asking!

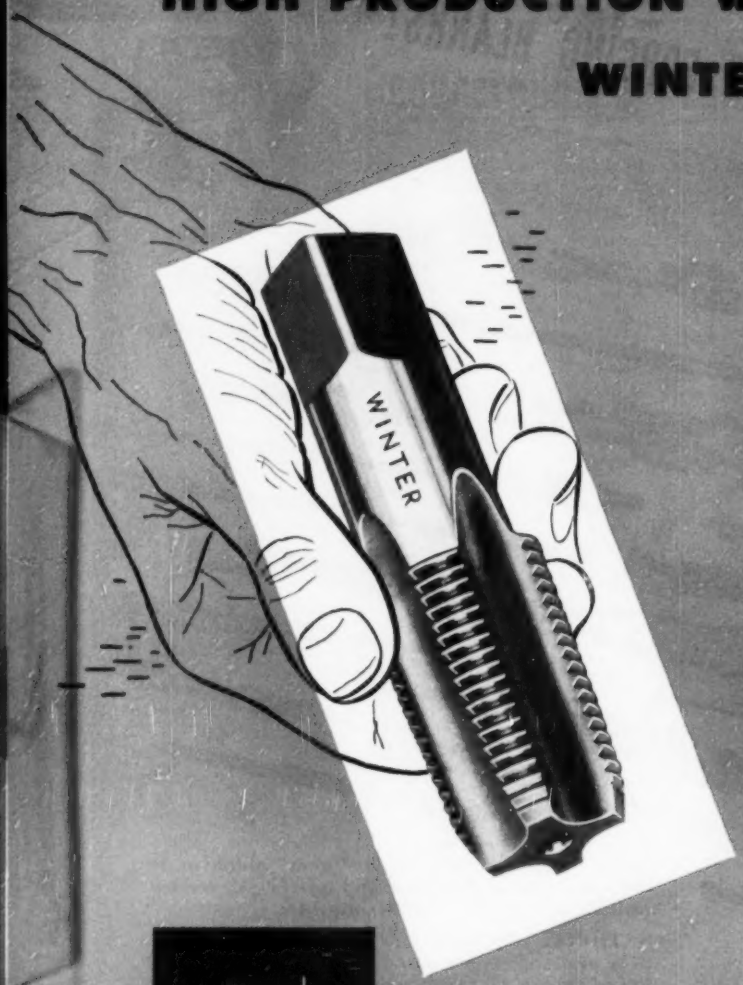
Let us help you investigate the application of REDUCEROLLING to your work. Send us a print or sample of your forging—or, better yet, pay us a visit. No obligation, of course.

NATIONAL
MACHINERY COMPANY
TIFFIN, OHIO.

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES—MAXIPRESSES—COLD HEADERS—AND BOLT, NUT, RIVET, AND WIRE NAIL MACHINERY

Hartford Detroit Chicago

HIGH PRODUCTION with WINTER PIPE TAPS



Leak-proof pipe joints on a production basis in all types of metals require pipe taps that combine precision with high performance.

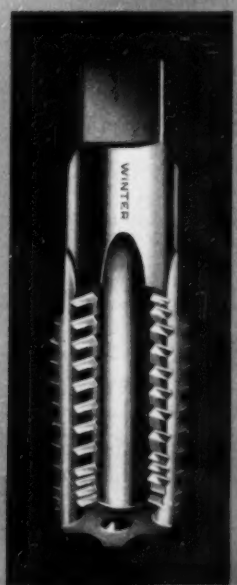
Winter "Balanced Action" Pipe Taps are the result of study and long experience in this field. Regular styles, Interrupted Thread, and Dry Seal styles are all available.

Special Pipe Taps for stainless steel and other difficult materials, as well as taps for unusual applications, are designed to your requirements by experienced Winter Tap Engineers.

Winter also makes and stocks Hand, Machine Screw, Chip Driver, Pulley, and Nut Taps, and many other types and sizes of threading tools.

ALWAYS AT YOUR SERVICE

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.



WINTER

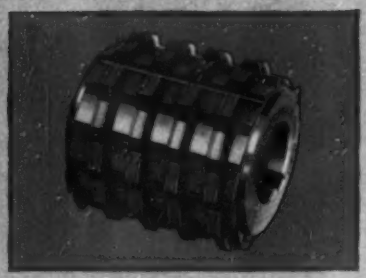
WINTER BROTHERS COMPANY • Division of the National Twist Drill and Tool Company, Rochester, Michigan, U. S. A. Distributors in Principal Cities • Branches in New York, Detroit, Chicago, San Francisco

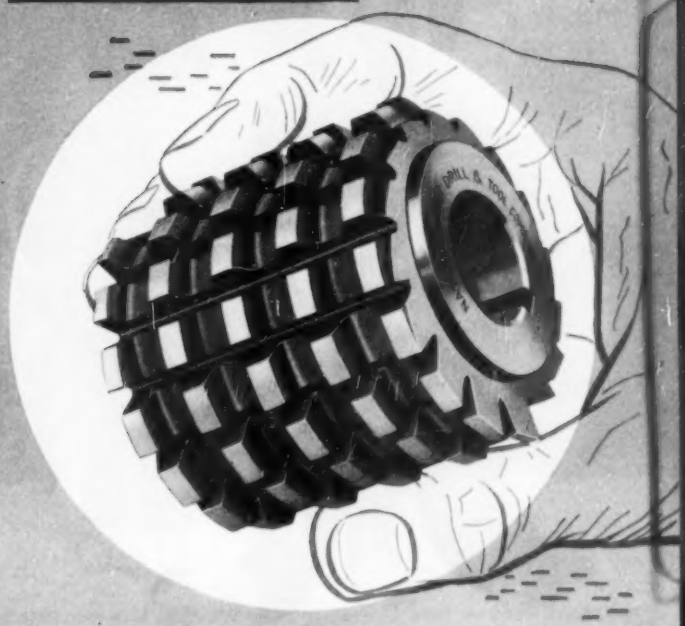
ACCURACY and LONG TOOL LIFE with NATIONAL HOBS

For continuous cutting of gear teeth, splines, and other symmetrical projections, the hobbing process is recognized as a most efficient method. However, both work accuracy and hob life depend on the quality and precision of the hob itself.

National Hobs have the inbuilt qualities born of sound engineering, exact processing, and long field experience. Furthermore, National hob specialists are always ready to assist you on new or troublesome jobs.

Other National products are Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, and Special Tools.





"CALL YOUR DISTRIBUTOR"— It is NATIONAL'S firm belief, based on long experience, that the local industrial distributor is the one best source for all simple industrial needs—including NATIONAL Metal Cutting Tools.

NATIONAL TWIST DRILL & TOOL ROCHESTER MICH U.S.A.

National

NATIONAL TWIST DRILL AND TOOL COMPANY •
Rochester, Michigan, U. S. A. Distributors in Principal Cities
Factory Branches: New York • Chicago • Detroit • Cleveland • San Francisco

stainless steel is a family affair

There's more than just one type of stainless steel . . . because *stainless* applies to a family of steels. And in order to get the best possible results from stainless in your application, the *right* analysis must be used.

That's why Crucible, a pioneer in the development of this specialty, offers you the services of an alert staff of metallurgists to help you with your stainless application problem.

Crucible's half century of specialty steel leadership is built on a strong foundation of service to Industry . . . with attention to detail . . . whether the order is in tons or pounds. From the ground up, Crucible designed and put into operation one of the first integrated mills built specifically to hot and cold roll stainless steel. This $18,000,000 addition gives Crucible facilities to provide industry with stainless in every form.

There is no substitute for Crucible's background of 50 years of specialty experience. Let Crucible show you how to apply stainless steels to your products. One call from you puts us to work on your application.

CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

CRUCIBLE first name in special purpose steels

STAINLESS STEELS

STAINLESS • HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE • STEELS

"Go" or "Not Go"?

This team of operator and inspector will not have to wait for Final Inspection to know the answer. Process checking at strategic points tells them and their management "how they are doing."

Such inspection warns when tools should be sharpened, machines checked or prior operations re-checked. It also warns when defective product should be discarded before more expense is put into it.

"Indeed a good gaging system soon pays for itself."

BUY GAGES WITH *CONFIDENCE*

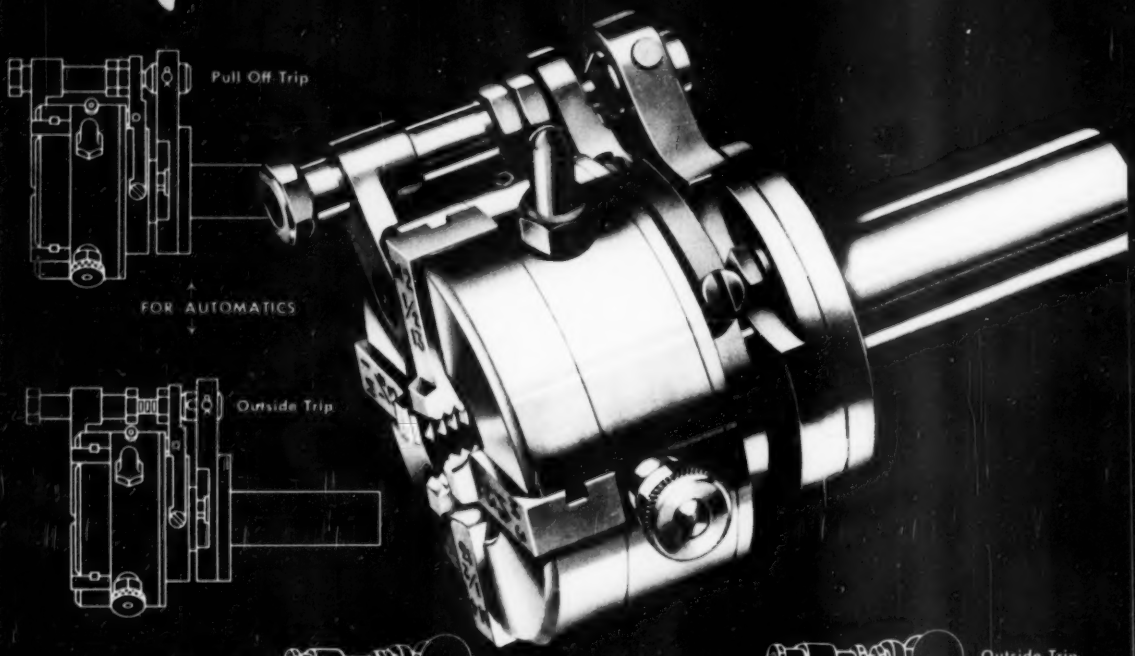
BUY *GREENFIELD* GAGES

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS

4 Heads in one

Convertible Die Heads with ALIGNING Shank



No new parts are required to convert the DS Geometric Die Head from Automatic to Hand Trip or from Pull Off to Outside Trip. It's not even necessary to remove the head from the machine!

DS Heads without the aligning feature are also available where alignment is not a problem.

WRITE FOR BULLETIN DS

BE SURE Buy GEOMETRIC

GEOMETRIC TOOL COMPANY DIVISION

GREENFIELD TAP AND DIE CORPORATION

NEW HAVEN 15, CONNECTICUT

DIVE DEEP

...into this million-dollar question!

. . . You may come up with SUNKEN TREASURE that you never knew you had!

HERE'S THE "$1,000,000 QUESTION": *"Can my product be made to COUNT — to the greater profit of its users?"* Now ask for the answer from a Veeder-Root engineer, experienced in discovering and developing hidden COUNT-ability in countless products. He'll tell you, quickly and frankly, whether *your* product has this modern merchandising magic . . . and show how to bring it out. Count on him to show you how to build Veeder-Root Counters into your product as integral parts . . . *and then see how sales will build up!* Write.

MEDIUM SIZE COUNTER (ratchet or revolution) is built into tabulators, shoe machines, punch presses, postage meters, knitting machines, die casting machines, compressors, and what have *you?* One of scores of standard V-R Counters described in 8-page "COUNT BOOK" below. Send for your copy today.

Veeder-Root COUNTERS "Count Anything on Earth"

VEEDER-ROOT INC., HARTFORD 2, CONN.

In Canada: Veeder-Root of Canada, Ltd., 955 St. James Street, Montreal 3
In Great Britain: Veeder-Root Ltd., Kilspindie Rd., Dundee, Scotland

"DOUBLING-UP" ON PRODUCTION

. . . *at* JARECKI MACHINE

300 PAIRS PER HOUR—The extra capacity and rigidity of Danly Presses permit flexibility of die arrangement. Every press in the Danly line is tooled with two sets of dies to stamp these automotive front door hinge pillars two at a time.

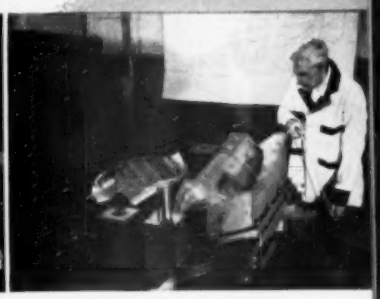
With press time at a premium and schedules pushing capacity to the limit, the advantages of Danly Press construction and engineering features are more important than ever. At Jarecki, the full-rated die capacity and extra slide rigidity of Danly Presses made possible production of the parts shown above in pairs—two at a stroke!

Danly Presses are built with machine tool precision, built to withstand the punishment of round-the-clock operation. Write today for the unusually complete Danly Straight Side Press Catalog. See how Danly Presses will help you meet production schedules.

STRAIGHT LINE ARRANGEMENT of the Danly Press line makes material handling fast and easy . . . and makes uninterrupted press operation a *must*. Danly features like complete pressure lubrication and "proved safe" controls assure minimum press down time.

DOUBLE DIE TOOLING used throughout the Danly line is shown in this close-up view. Extra long, precision gibs contain the entire slide at all times during the working stroke, providing the extra rigidity to make this "double production" set-up possible!

FULL-RATED DIE SPACE is an important feature of Danly Press design, particularly when big drawing dies like the one shown here are used. Danly presses have the *designated* die space between the gibs.



PRECISION DRAWING DIES for production stamping of important automotive and home appliance components are produced in the modern Jarecki tool room, one of the largest tool and die job shops in the world.

WITH DANLY PRESSES

and **TOOL COMPANY** • *Grand Rapids, Michigan*

A DANLY LINE AT JARECKI — First drawing operation is performed on the lead 500-ton Danly Double Action Press, setting the pace for the line. Since installation, this press has not required any unscheduled down time for emergency maintenance.

SEND FOR YOUR FREE COPY TODAY!

DANLY

Mechanical Presses . . . 50 to 3000 Tons

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

Finish Your Metal Parts
in One.. Fast..
Economical operation
with ALUNDUM Tumbling
Abrasive and Barrel Finishing!
YES, you can now finish large quantities of intricate metal parts to exact dimensions and exact degrees of surface finish —and prepare them for plating—all in one fast, economical operation.
Plants everywhere are saving money by eliminating many slow, expensive hand-finishing operations and switching to barrel finishing with Norton ALUNDUM Tumbling Abrasive as the finishing medium.
For full details, contact your Norton abrasive engineer or distributor, or write direct to the Sales Engineering Department.
NORTON COMPANY • WORCESTER 6, MASS.
Distributors In All Principal Cities
NORTON
ABRASIVES
Making better products to make other products better

USE STANDARD SIZES TO INSURE PROMPT DELIVERY

The UNBRAKO Knurled Socket Head Cap Screw

Ask for your copy of the UNBRAKO Catalog of Socket Screw Products.

Knurling of Socket Screws originated with UNBRAKO in 1934.

Knurled Head Socket Cap Screws
Flat Head Socket Cap Screws
Self-Locking Socket Set Screws

SOCKET **UNBRAKO** SCREWS

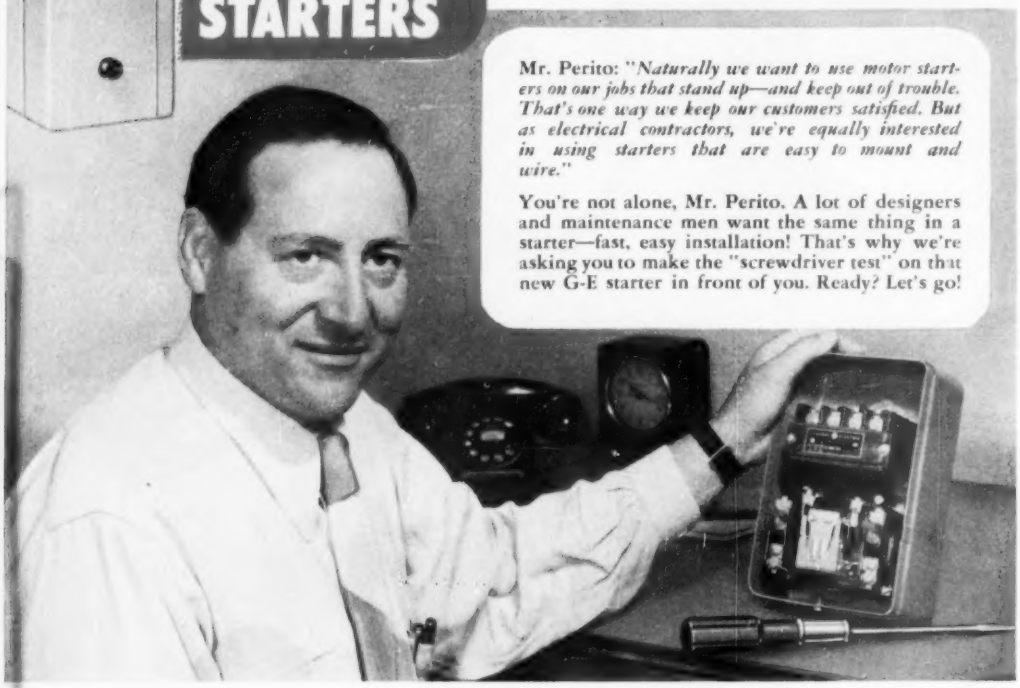
Knurled Head Stripper Bolts
Precision-Ground Dowel Pins
Fully-Formed Pressure Plugs

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 1, PENNSYLVANIA

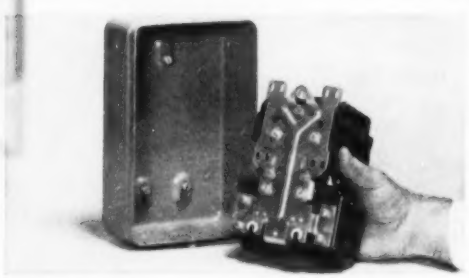
MOTOR STARTERS ...easier to

T.G. PERITO, ELECTRICAL CONTRACTOR, LEARNS

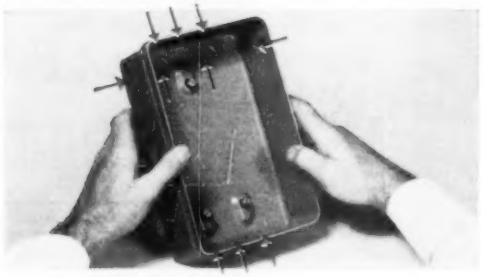


Mr. Perito: "*Naturally we want to use motor starters on our jobs that stand up—and keep out of trouble. That's one way we keep our customers satisfied. But as electrical contractors, we're equally interested in using starters that are easy to mount and wire.*"

You're not alone, Mr. Perito. A lot of designers and maintenance men want the same thing in a starter—fast, easy installation! That's why we're asking you to make the "screwdriver test" on that new G-E starter in front of you. Ready? Let's go!



1 Mr. Perito: "*How is this contactor mounted in the case?*"
By means of keyhole slots you see in the contactor base, Mr. Perito. After you've mounted the empty case on the wall or a machine, you locate the keyhole slots over the mounting screws and the contactor slips into place!



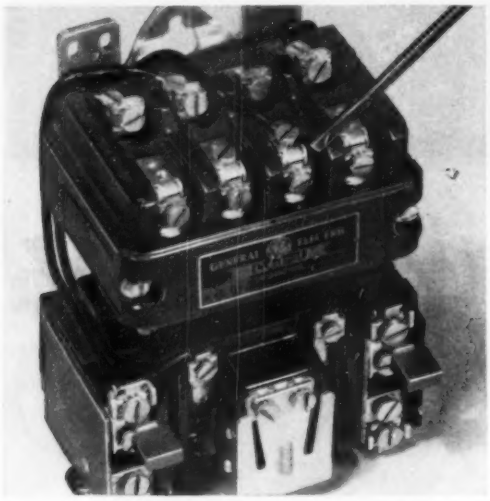
2 Mr. Perito: "*Lots of knockouts, I see!*"
You'll find these on every side of the case—more than enough to give you faster, neater installations. Plenty of room on the inside, too, and notice how the light grey finish on the inside gives you plenty of reflected light!

GENERAL ELECTRIC

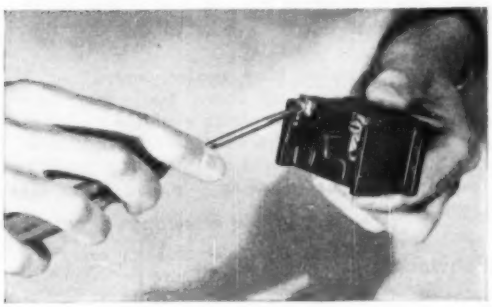
7N-18

install for these 6 reasons

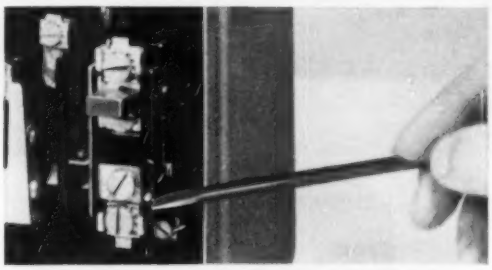
ABOUT THESE IMPORTANT FEATURES WITH THE "SCREWDRIVER TEST"



3 Mr. Perito: "*Are all the terminals easy to get at?*" Every one of them is *up front* where it's easy to get at, and wire. And they're *big* terminals with panhead screws and saddle-type connectors that ride up with the screw head. The stripped wire simply slides into place and is easily secured with a turn of your screwdriver.



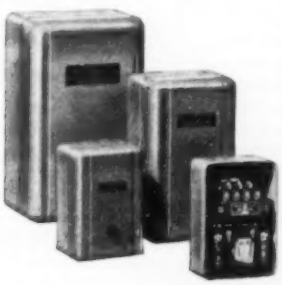
4 Mr. Perito: "*Tough-looking coil! Is it new?*" Right! It's called the "Strongbox Magnet Coil" and it's an exclusive with the new G-E starter line. Feel how solid it is! If your electrician's screwdriver slips, it can't hurt the windings—they're safely locked in a block of molded plastic. And oil, dust or water can't get at them, either!



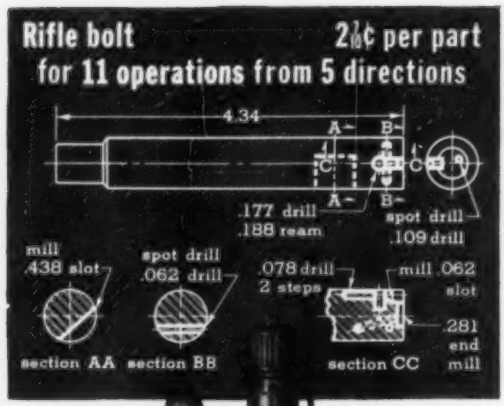
5 Mr. Perito: "*How do I set the overloads?*" Easy—and you don't have to take the starter apart to do it. Flip that little lever and it's on "Automatic." Flip it back and it's on "Manual." Heaters are in the front, can be changed without disturbing any wiring.

6 Mr. Perito: "*What about maintenance?*" Once this new G-E starter is installed, it *stays* installed. There's no need to remove the case for ordinary maintenance or even to replace or reverse contacts. Just remove the arc chute and there are your terminals.

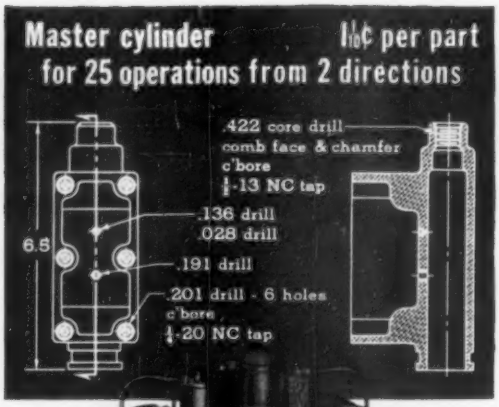
WHY DON'T *YOU* "BUY ONE AND COMPARE?"

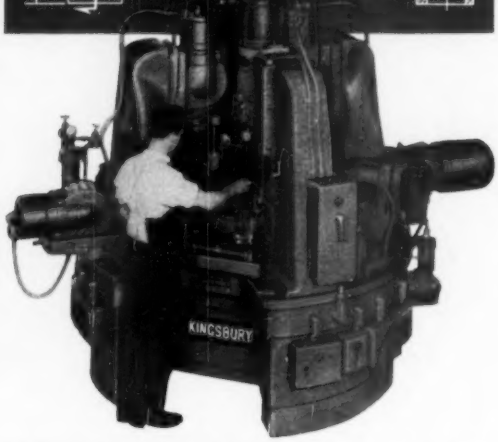


See for yourself why this new line of G-E motor starters lasts longer, costs less to install than almost any other starter you can buy. Your G-E representative or authorized G-E agent or distributor can supply you from stock in NEMA sizes 0, 1, 2 and 3 for a-c motors up to 50 hp. For a complete description, write for Bulletin GEA-5153. Section 730-18, *Apparatus Dept., General Electric Company, Schenectady 5, New York.*



330 PARTS AN HOUR GROSS. On this 40-inch "Auto-Index" 12 vertical unit mills the .438 slot; four units on the central column and inverted at 45° do the .062 and .188 holes; six units on the base do four axial operations and the .109 angular hole.





630 PARTS AN HOUR GROSS. A 20-inch power index table has eight fixtures. Four vertical units operate on the axial hole. Six horizontal units, three with 6-spindle auxiliary heads, operate on the other holes. The .028 drill runs at 14,000 rpm.

Cut unit costs with many

High production drilling and tapping machines, either simple or complex, combine operations to save money

Dear Sir:

These high production machines save money. The pay-off period is one to three years, or even less.

Each machine here replaces several general-purpose machines. One man loads and unloads each one. Automatic drilling and tapping units of 1/3 to 5 hp do the operations. That means a big saving in direct labor, some saving in handling and space.

Scrap is less, since each machine produces uniform, accurate parts. Automatic work cycles never vary. Fixtures and index tables are jig-bored to such close limits that parts from all fixtures are exactly alike. Bushings locate drills and reamers to close tolerances.

Savings not always obvious

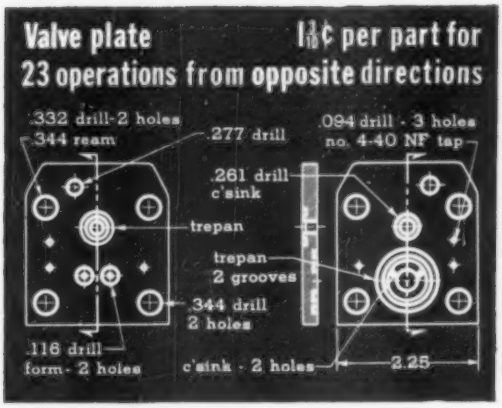
"A new Kingsbury," says an article in *American Machinist*, "drills, reams and countersinks both ends of a small roller, has cut time to only 0.18 min. per piece. Even though there is only enough work to operate it about a week a month, it has already paid out in labor and scrap savings."

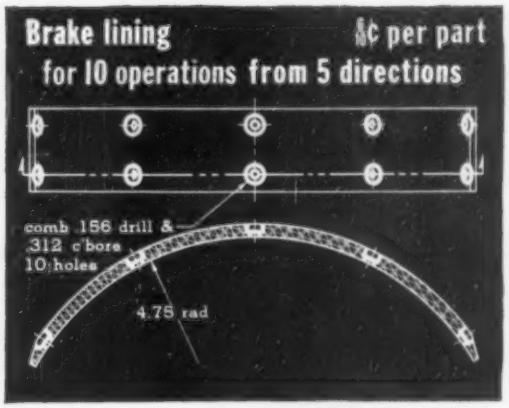
Firms have ordered Kingsburys when they needed only 25 or 30 parts an hour. You might think those machines would be a poor investment. But in each case someone figured out that there would be a good saving.

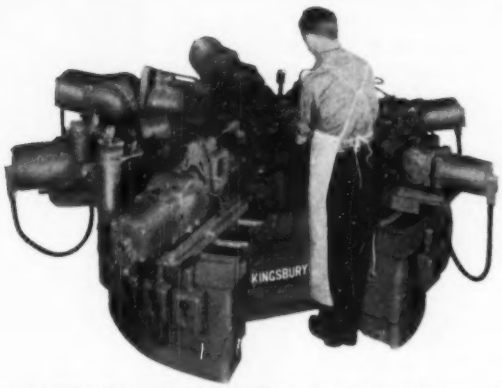
Not on old envelopes now

It used to be that you could take a proposal and figure the savings on any handy piece of paper. Nowadays many people use a work sheet of some kind. For one thing, it is easier for others to follow the figuring.

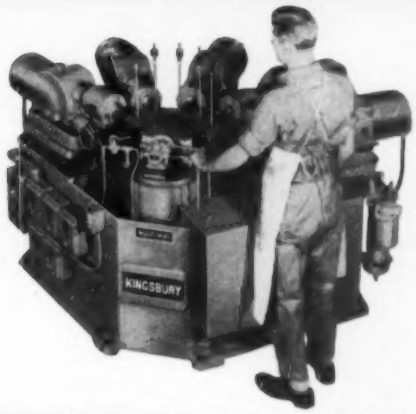
There is a good work sheet in the National Machine Tool Builders' booklet, *Computing Return on Invested Capital*. They describe the method fully. If you want a book-







500 PARTS AN HOUR GROSS. Each part passes twice around this machine. A 20-inch index table has eight double fixtures, each holding one part on each pass. Seven multi-spindle units do all 23 operations. Bushings guide all tools but the taps.



830 PARTS AN HOUR GROSS. Drop a part in the fixture and trip a lever. The fixture locates and clamps. Five 2-spindle units operate. The fixture unclamps and ejects. Time: 3½ secs. The operator can adjust the units to operate on similar linings.

operations per chucking

let free, ask us on your business letterhead.

Unit costs on the drawings

Not to be outdone, this is how *we* figured each unit cost above. It includes only the cost of the man and of the machine. We assumed:

Unit cost of the man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross x 80\% efficiency}}$$

Unit cost of the machine equal to:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hours @ 80\% efficiency}}$$

You may not like our assumptions on efficiency, wage rate or 6000 hours. But at least the method is sound. We had to assume things, but you can use *actual* figures. You get a realistic result, whether or not your machine runs full time.

Instead of an average hourly wage you can use your actual wage (with or without hourly fringe benefits). Instead of output in 6000 hours, you can use your output in either your pay-off or "useful life" period.

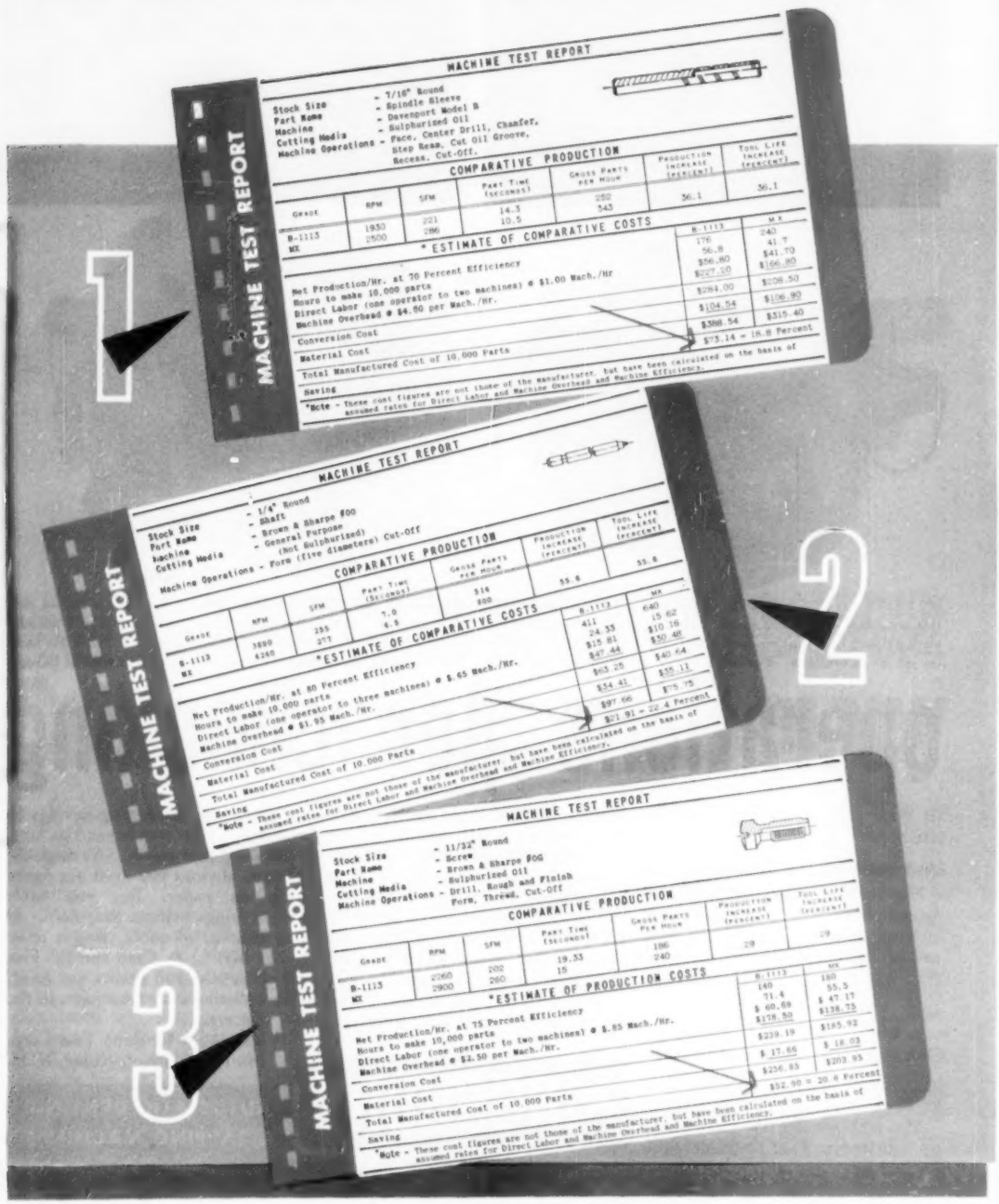
You can complete the picture by comparing that cost with your unit cost now and estimating savings in overhead. That was beyond us here.

Don't get us wrong. Savings are often so obvious you need not figure them on paper. But you can't judge savings without proposals. If you want us to quote, send a print to our Mr. L. A. Carll and tell him the operations and output you need. Free bulletins show what we can do.

Sincerely,
Kingsbury Machine Tool Corp.
140 Laurel Street, Keene, N. H.

KINGSBURY
AUTOMATIC DRILLING & TAPPING MACHINES
for Low-Cost High Production

Look how costs come down


1
MACHINE TEST REPORT
MACHINE TEST REPORT
Stock Size - 7/16" Round
Part Name - Spindle Sleeve
Machine - Davenport Model B
Cutting Media - Sulphurized Oil
Machine Operations - Face, Center Drill, Chamfer, Step Ream, Cut Oil Groove, Recess, Cut-Off.
COMPARATIVE PRODUCTION
Gears RPM SFM Part Time (Seconds) Gross Parts Per Hour Production Increase (Percent) Tool Life Increase (Percent)
B-1113 1930 221 14.3 252 56.1 56.1
MX 2500 286 10.5 343
* ESTIMATE OF COMPARATIVE COSTS
Net Production/Hr. at 70 Percent Efficiency 176 240
Hours to make 10,000 parts 56.8 41.7
Direct Labor (one operator to two machines) @ $1.00 Mach./Hr $56.80 $41.70
Machine Overhead @ $4.00 per Mach./Hr. $227.20 $166.80
Conversion Cost $284.00 $208.50
Material Cost $104.54 $106.90
Total Manufactured Cost of 10,000 Parts $388.54 $315.40
Saving $73.14 = 18.8 Percent
*Note - These cost figures are not those of the manufacturer, but have been calculated on the basis of assumed rates for Direct Labor and Machine Overhead and Machine Efficiency.
2
MACHINE TEST REPORT
MACHINE TEST REPORT
Stock Size - 1/4" Round
Part Name - Shaft
Machine - Brown & Sharpe #00
Cutting Media - General Purpose (Not Sulphurized)
Machine Operations - Form (five diameters) Cut-Off
COMPARATIVE PRODUCTION
Gears RPM SFM Part Time (Seconds) Gross Parts Per Hour Production Increase (Percent) Tool Life Increase (Percent)
B-1113 3880 255 7.0 514 55.6 55.6
MX 4240 277 6.0 600
* ESTIMATE OF COMPARATIVE COSTS
Net Production/Hr. at 80 Percent Efficiency 411 640
Hours to make 10,000 parts 24.33 15.62
Direct Labor (one operator to three machines) @ $.65 Mach./Hr. $15.81 $10.16
Machine Overhead @ $1.95 Mach./Hr. $47.44 $30.48
Conversion Cost $63.25 $40.64
Material Cost $54.41 $55.11
Total Manufactured Cost of 10,000 Parts $97.66 $75.75
Saving $21.91 = 22.4 Percent
*Note - These cost figures are not those of the manufacturer, but have been calculated on the basis of assumed rates for Direct Labor and Machine Overhead and Machine Efficiency.
3
MACHINE TEST REPORT
MACHINE TEST REPORT
Stock Size - 11/32" Round
Part Name - Screw
Machine - Brown & Sharpe #0G
Cutting Media - Sulphurized Oil
Machine Operations - Drill, Rough and Finish Form, Thread, Cut-Off
COMPARATIVE PRODUCTION
Gears RPM SFM Part Time (Seconds) Gross Parts Per Hour Production Increase (Percent) Tool Life Increase (Percent)
B-1113 2260 202 19.33 186 29 29
MX 2900 260 15 240
* ESTIMATE OF PRODUCTION COSTS
Net Production/Hr. at 75 Percent Efficiency (40 180
Hours to make 10,000 parts 71.4 55.5
Direct Labor (one operator to two machines) @ $.85 Mach./Hr. $ 60.69 $ 47.17
Machine Overhead @ $2.50 per Mach./Hr. $178.50 $138.75
Conversion Cost $239.19 $185.92
Material Cost $ 17.66 $ 18.03
Total Manufactured Cost of 10,000 Parts $256.85 $203.95
Saving $52.90 = 20.6 Percent
*Note - These cost figures are not those of the manufacturer, but have been calculated on the basis of assumed rates for Direct Labor and Machine Overhead and Machine Efficiency.

when you do the job with MX

the new free-machining Bessemer screw stock!

U·S·S Free-Machining MX Bar Stock cuts costs in four ways:—(1) By increasing the rate of production it lowers the cost per part produced. (2) By prolonging tool life and minimizing or eliminating tool failure it reduces tool costs and downtime. (3) By ensuring better part finish it often makes possible the elimination of extra finishing operations. And (4) By making it easier to adhere consistently to required tolerances it reduces time out for tool adjustment and minimizes rejections.

● You can safely figure that MX will cut the cost of *any* part you now machine from ordinary Bessemer screw stock—whether machine work is much or little. What's more, the higher the conversion cost in comparison to the material cost, the greater your savings will be.

● The machine test reports on the opposite page show how profitable it is to use MX Bar Stock. These are estimates of comparative costs on three typical screw machine parts produced with MX. Note how little it costs to obtain substantial savings with MX. In test No. 1, $2.36 extra for MX saves $73.14 on 10,000 parts; in test No. 2, 70 cents extra for MX saves $21.91; in test No. 3, for only 37 cents more, MX results in a saving of $52.90.

● Prove for yourself how the superior cutting properties of MX will increase your output and reduce your costs. Give this free-machining Bessemer screw stock a thorough trial on your own equipment. We believe that the results will convince you that free-machining MX is the most efficient and the most *economical* bar stock you have ever used.

● MX is being produced in all the popular bar sections and sizes. You can obtain it in cold finished form from your regular supplier as "MX," or under his own identifying trade name. In hot rolled bars, MX is available direct through our nearest district sales office.

● *For more parts and better parts—at lower cost per part*—standardize on MX.

AMERICAN STEEL & WIRE COMPANY, CLEVELAND
CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH
COLUMBIA STEEL COMPANY, SAN FRANCISCO
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

*These machine test reports are reproduced from an article on Bessemer MX Steels by Mr. George R. Caskey, Metallurgical Engineer, Bliss & Laughlin, Inc. which appeared in Screw Machine Engineering, June 1950 issue.

USS

Carnegie-Illinois Steel Corporation
Room 2162, Carnegie Bldg., Pittsburgh 30, Pa.

Please send me a copy of MX Bulletin.

Name.....

Company.....

Address.....

City.....Zone.....State.....

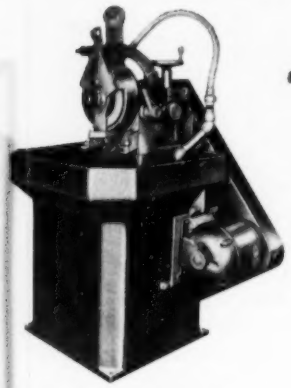
UNITED STATES STEEL

Making A Standard For — Tomorrow

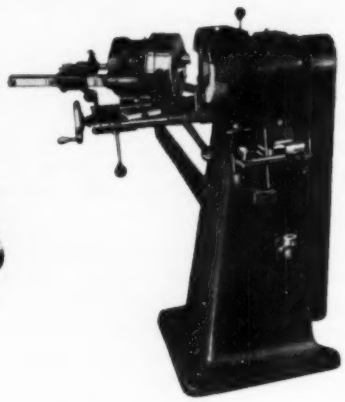
OLIVER OF ADRIAN

OLIVER OF ADRIAN

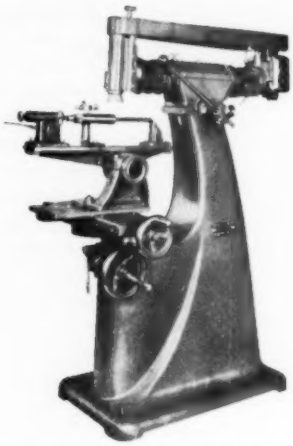
For 30 years Oliver of Adrian has designed and manufactured precision machines with the firm thought of the future. Oliver Instrument Company is dedicated to the task of producing for American Industry the ultimate in cost reducing toolroom machinery. Oliver gives you that "something extra" that is vital to outstanding performance.



Oliver Template Tool Bit Grinder (2 models)



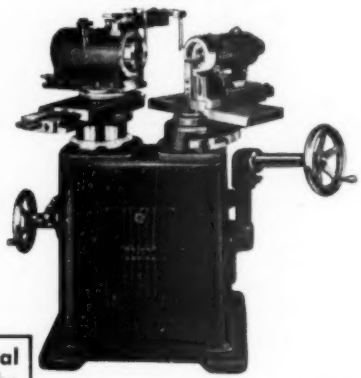
Oliver No. 510 Drill Pointer



Oliver Ace Tool and Cutter Grinder (2 models)

Oliver Diemaking Machine (5 Models)

Oliver No. 21 Bench Drill Grinder



Oliver No. 2 Arc Face Mill Grinder (2 Models hand operated or fully automatic)

Write today for complete technical information on any or all of the above machines illustrated. Your inquiries solicited.

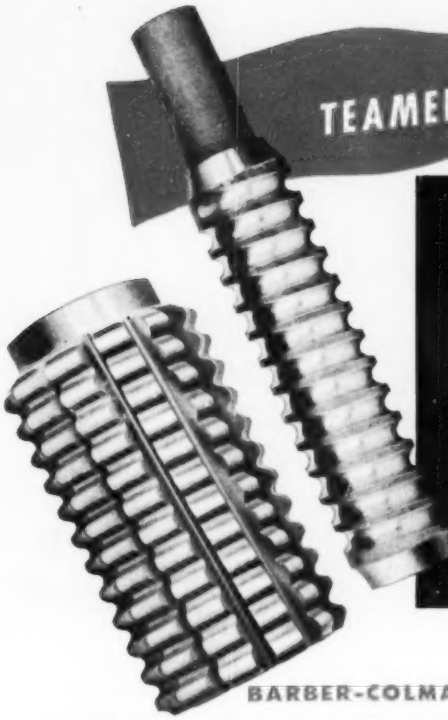
OLIVER OF ADRIAN

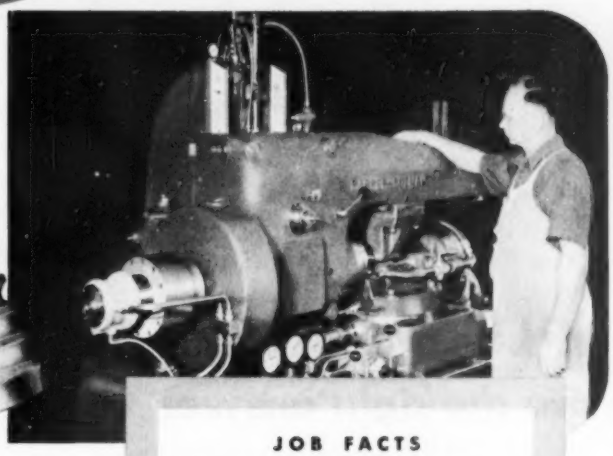
OLIVER INSTRUMENT CO.

1414 E. MAUMEE • ADRIAN, MICHIGAN

AUTOMATIC DRILL GRINDERS · TOOL & CUTTER GRINDERS—DRILL POINT THINNERS—TEMPLATE TOOL GRINDERS—FACE MILL GRINDERS—DIEMAKING MACHINES

TEAMED FOR *Production!*





JOB FACTS

Operation — Mill Threads on Ball-Nut Steering Worm
Material — 5120 Steel
Cutters — B-C Unground Multiple Thread Cutters, 4" x 4⅛" x 1½"
Machine — B-C No. 14-15
Feed — .640"/minute (axial)
Speed — 160 RPM
Floor-to-Floor — 1.6 minutes per piece
Cutter Life — 7175 pieces

THREAD MILLING CUTTERS AND No. 14-15 HOBBING MACHINE

MILL BALL-NUT STEERING WORMS IN 1.6 MINUTES FLOOR-TO-FLOOR

Engineered-for-the-job, these Barber-Colman Multiple Thread Milling Cutters are "teamed" with a Barber-Colman No. 14-15 Hobbing Machine to give faster output in worm thread milling. Results of this engineered combination are floor-to-floor time per worm of 1.6 minutes, and an average of 300 pieces per cutter sharpening. Cost per worm naturally has been greatly reduced.

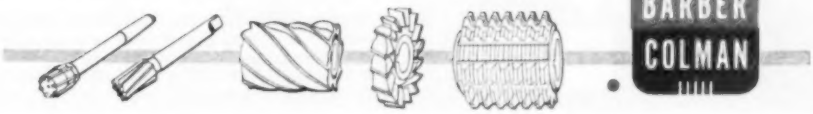
For that extra production bonus on milling operations, consult Barber-Colman engineers. Their experience with cutting tools engineered-for-the-job can save both time and money in getting the job done right.

FREE

Get this complete catalog of Standard and Special Milling Cutters and Reamers. Write for File No. 8148.

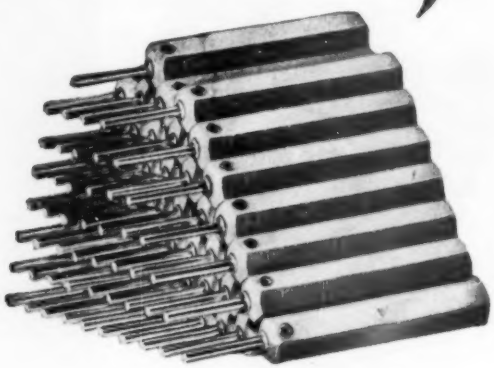
Barber-Colman Company

GENERAL OFFICES AND PLANT, 8148 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.



Van Keuren

CARBOLOY
Wire Type
PLUG GAGES
are the right answer



1 VK CARBOLOY=50 TOOLSTEEL GAGES

After considerable experimentation with various wear resistant materials, we have chosen Carboloy as being the most practical, durable and economical. Carboloy does not flake or chip easily and is quite suitable for wire type plug gages as small as .020" in diameter.

Wire Type Plug Gages were originated by the Van Keuren Co. in 1925 and are now recognized as the most economical gages for measuring small holes. The original wire type plug gages were made of tool steel—High Speed steel doubled gage life. VK Chromium Plate gave 5 times the life, and VK Carboloy 50 times the life of tool steel gaging units. All of these materials are still in use and have their particular applications.

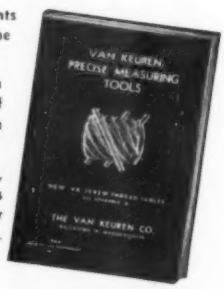
VK Carboloy gaging units are made in sizes from .020" to .500" diameter. They are made only in the wire type design because this is by far the most economical plug gage. In cases where it is desired to use VK Carbloay wire type Go units with existing No Go taper insert unit, special handles can be furnished for this purpose.

Van Keuren Wire Type Plug Gages assure longer lasting precision and lower gage cost, because the entire 2" length of gage can be used. When the end of the wire becomes worn, it is ground off. The wire type unit is securely held in the unit by a split bushing and a headless set screw.

VK Carboloy Wire Type Plug Gages are made to Class B accuracy, plus .00005", minus .00000" on the Go unit and plus or minus .000025" on the No Go unit. Closer or wider tolerances can be supplied if desired.

On your next order Specify VK Wire Type Plug Gages; VK Carboloy for long runs because of the enormous saving in gage cost; VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits; VK Tool Steel—High Speed Steel—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

CATALOG AND HANDBOOK No. 34



This 213 page volume represents 2 years of esearch sponsored by the Van Keuren Co.

It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

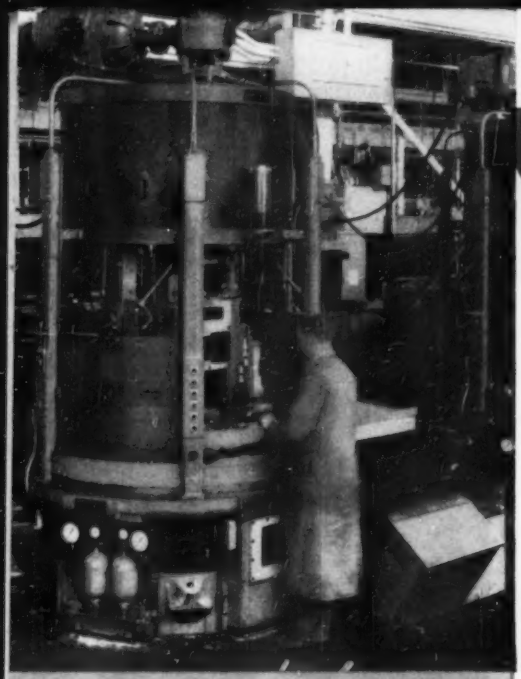
It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies free upon request.

THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires



TYPE "K" 6 STATION 12-SPINDLE MULT-AU-MATIC

83%

INCREASE In Production

Type "K" Mult-Au-Matic 550 Pcs

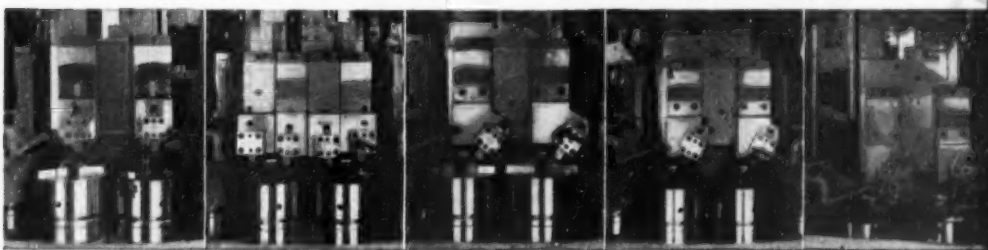
Type "D" Mult-Au-Matic 300 Pcs

A QUOTATION FROM THE FIELD:

"We were especially impressed on this job with the ease in which the operator was able to load and unload this machine at the rate of 550 pcs. per hour compared with the operator on the 8 spindle double index Type "D" Mult-Au-Matic on the same operation, who was busy trying to produce 300 per hour."

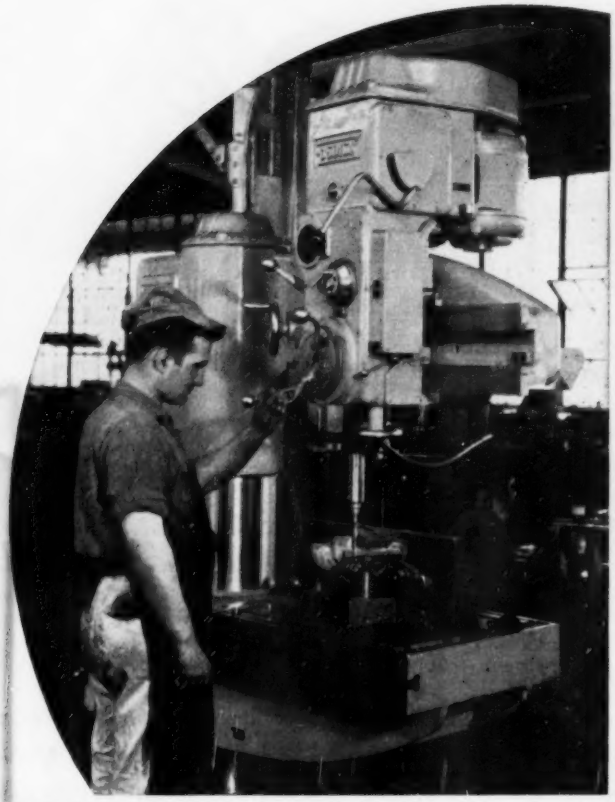
Twin spindles and twin tooling at each station, and each station with its succeeding operations, provides a progressive, high efficient Production Method on Differential Side Gears.

Ask for information on Type "K" Mult-Au-Matic application to your work.



Refinement in design, higher spindle speeds, faster index and in many cases an improved method for 1st and 2nd chucking on the same machine are only some of the factors that place the Type "K" Mult-AU-Matic in a class by itself for Productive Economies.

THE BULLARD COMPANY BRIDGEPORT 2, CONNECTICUT



For PRODUCTION
For MACHINE SHOPS
For TOOL ROOMS

FOSDICK *Sensitive* RADIAL

• Wherever there's a need for holes up to 1½" diameter it will be to your advantage to investigate this exceptionally versatile machine.

The sturdy construction of the Fosdick Sensitive Radial from base to arm—the rigid one piece column—the heavy adjustable table—and the massive arm all contribute to accurate, dependable production.

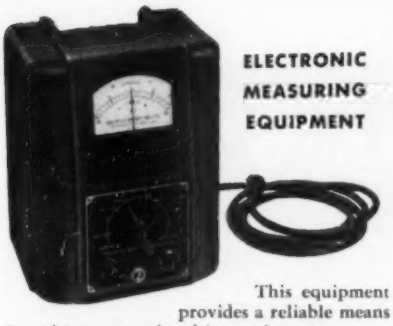
Ease of operation is assured due to centralization of controls on the head within easy reach of the operator at all times. Both table and arm swing in an arc of 360°. The adjustability of the table enables operator to locate the table in correct position for every job. It also enables him to swing the table out of the way in the event an emergency tall job comes up that may be mounted on the conventional base.

The Fosdick Sensitive Radial offers all the advantages of high speed sensitive drilling plus the versatility of radial design and construction.

The illustration shows an installation in a machine shop in eastern Pennsylvania. Whether yours is a production plant—a machine shop—or a tool room you'll find this machine is a most profitable investment.

For complete details write for the Fosdick Sensitive Radial Bulletin—S.R.A.

FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO



ELECTRONIC MEASURING EQUIPMENT

This equipment provides a reliable means for taking external and internal measurements with precision and ease that advance accurate manufacture and size control. By a simple turn of graduation selector, tolerances can be checked from "tenths" to "hundredths".

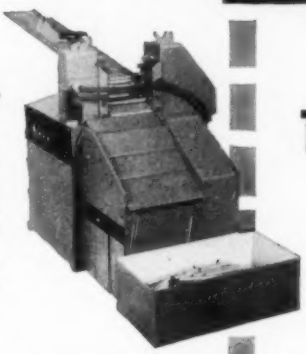
Exclusive advantages: any graduation value between .0001" and .00001" . . . separate amplifier completely isolates heat-producing elements . . . true linear response of amplifier permits accurate setting for entire scale with only 1 gage block . . . amplifier may serve several separate testing instruments.

External comparator with range of 0-4". Simplified setting. One master only. Reversible anvil. Self-checking. Shock-protected. Diamond gaging point.

Internal comparator attachment for use with external comparator and amplifier . . . range ½" to 2". Frictionless. No parts to wear. Only one master.

Gage head cartridge for mounting in jigs, fixtures or similar testing pieces. Measurement range .002". Frictionless. Dust and moisture proof.

ELECTRONIC INSPECTION AND SORTING EQUIPMENT



Unique design . . . manual loading and disposal to fully automatic . . . custom-engineered at Brown & Sharpe to meet individual requirements. Simplification of parts and functions makes machines more compact, more dependable.

JOHANSSON GAGE BLOCKS

. . . world famous both for their extreme accuracy and for their fast-growing importance to manufacturing of interchangeable parts. These precision aids to quality control are made by Brown & Sharpe; from single blocks to complete sets and useful accessories. Jo-Blocks have hundreds of cost-saving uses.

Take your cost cutting cue from this

QUALITY CONTROL EQUIPMENT

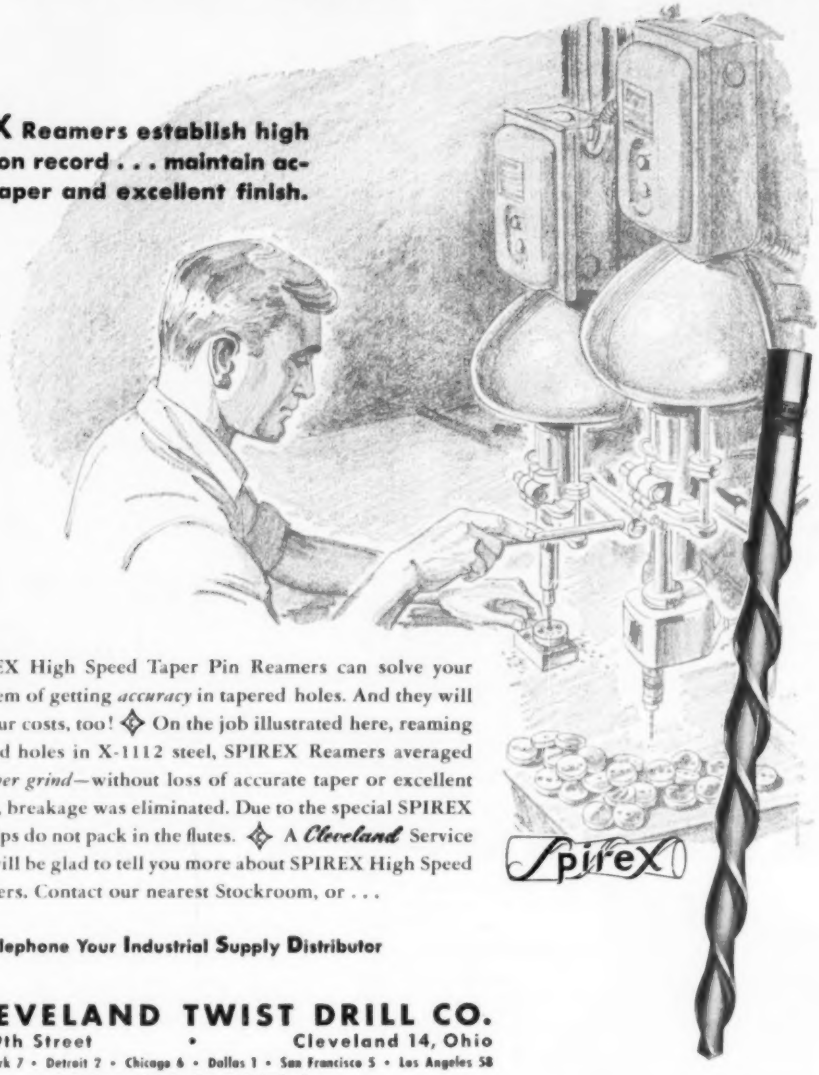
With any one of these modern quality control devices, you can lay the foundation for an efficient, cost-cutting quality control program. Each device offers thoroughly-proven features that broaden the advantages of quality control. All reflect the high precision standards associated with the Brown & Sharpe name. For complete details, write Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

BROWN & SHARPE

400 to 500 HOLES Per Grind!

SPIREX Reamers establish high production record . . . maintain accurate taper and excellent finish.



SPIREX High Speed Taper Pin Reamers can solve your problem of getting *accuracy* in tapered holes. And they will cut your costs, too! ◈ On the job illustrated here, reaming tapered holes in X-1112 steel, SPIREX Reamers averaged *400 to 500 parts per grind*—without loss of accurate taper or excellent finish. Moreover, breakage was eliminated. Due to the special SPIREX construction, chips do not pack in the flutes. ◈ A *Cleveland* Service Representative will be glad to tell you more about SPIREX High Speed Taper Pin Reamers. Contact our nearest Stockroom, or . . .

Telephone Your Industrial Supply Distributor

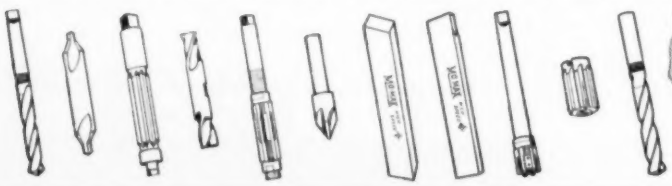
THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

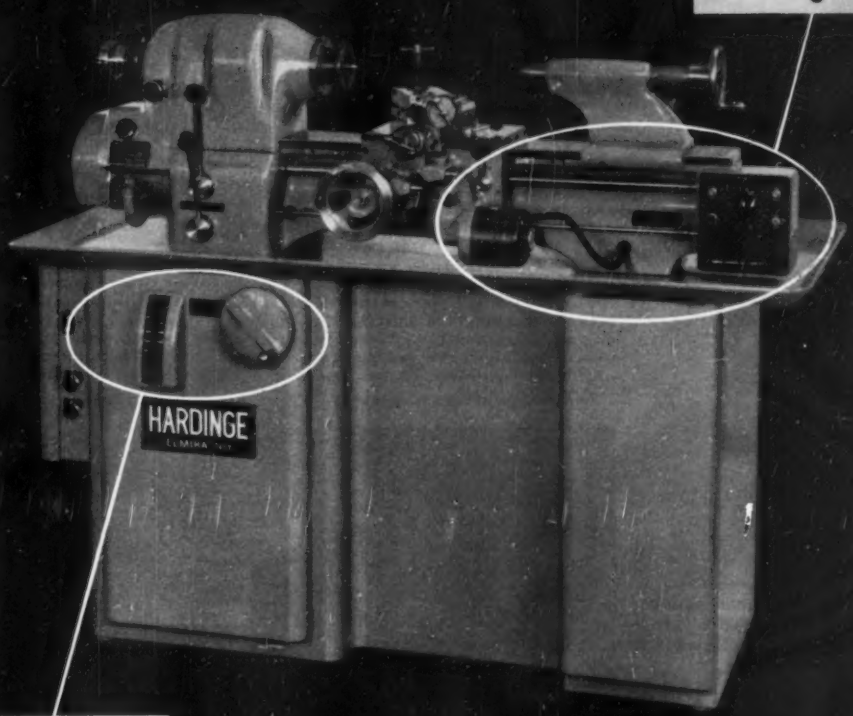
ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS



Infinite Control of Speed and Feed

is a feature of the HARDINGE ELMIRA, N.Y.

Tool Room and Production Lathe



Both drives are independent and infinitely variable to secure every possible combination of speeds and feeds within the following range:

Variable Speeds: 125 to 3100 r.p.m.
Variable Feeds: ¼" to 7" per minute

Write HARDINGE *for Bulletin HLV*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

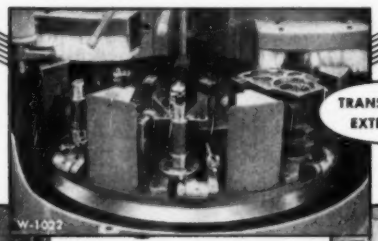
Offices in principal cities. Export office 269 Lafayette St., New York 12, N. Y.

Put them on a Blanchard

NO. 16-A2 AUTOMATIC

This two-spindle surface grinder is a real producer. In a single pass, the work is roughed by one wheel and then finished by the second wheel. Because each wheel can be selected for its part of the grinding operation, without having to compromise between roughing and finishing, the No. 16-A2 is particularly suited to work requiring high production. Close limits are assured by automatic size control for each wheel. If you're looking for maximum results with minimum effort, get production details on just how fast your own work can be done on the No. 16-A2.

Send blueprints or samples — there is no charge or obligation.

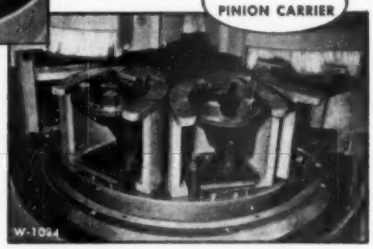


TRANSMISSION EXTENSION

PINION CARRIER BEARING CAPS

The joint face is ground by loading the cast iron part over a post, locating from a shoulder, supporting the flange by a spring bunter. It is clamped automatically. Parts are held flat to .001", square with bore to .002", and to ±.001" for size. 84 pieces ground per hour on one side.

REAR AXLE PINION CARRIER



These cast iron caps are placed in suitable stations, automatically clamped, ground, and automatically unclamped. 1020 caps per hour are ground to ±.003", and flat to .002" in a 20 station fixture. 1/16" of stock is removed per side.

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

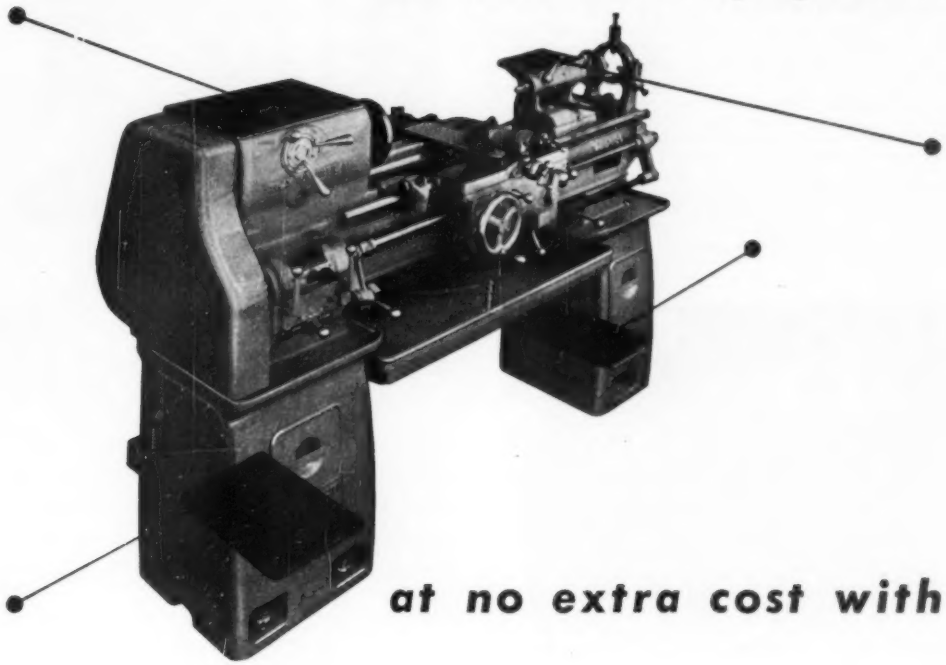
These cast iron parts are loaded with the flange under a "U" shaped block, clamped upward against the block. The four bearing surface "feet" are ground to limits of ±.003", parallel to flange within .001". 229 pieces are ground per hour on one side.

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY 64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

extra space

is standard equipment



at no extra cost with

tray-top cintilathes

Tray-Top engine lathe operators **get more work done** by having tools, mikes, accessories, etc., instantly within reach, right on top of the headstock and tailstock that gave this light duty lathe its name. No temptation to clutter the bed ways, convenience and safety assured . . . moreover, the spacious cabinet legs **really** have space for the operator to keep accessories safely out from under foot. Bench space requirements are cut or eliminated all together.

Only Tray-Top combines, in one machine, this and other valuable safety and convenience features such as enclosed quick change box, simple three lever "color-match" speed selector, twelve speeds, drop levers, start-stop apron control, long taper key drive spindle nose, built-in leveling jacks, external accessible mounting of main drive motor, low voltage controls (transformer included for 220 volt and over)—make Tray-Top your next buy—it's your best buy.

CINTILATHE

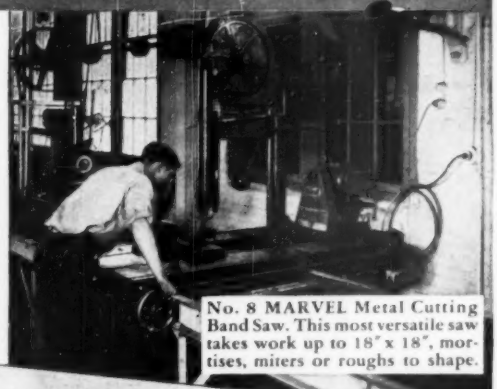
OF OUTSTANDING VALUE

CINCINNATI 9, OHIO, U.S.A. cincinnati lathe & tool co.

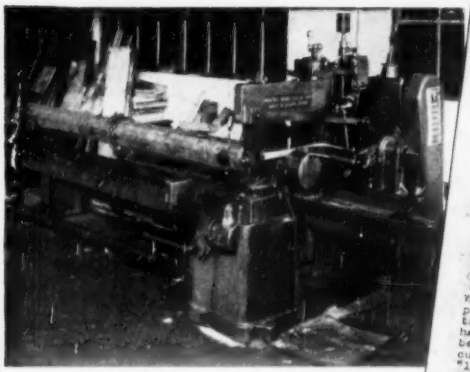
WHICH IS BETTER FOR YOU, HACK SAWS OR BAND SAWS ?

Reading Chain & Block Corporation found the answer by contacting the MARVEL field engineer. Only a MARVEL engineer could analyze this problem without bias because only MARVEL makes both hack saws and band saws. As a result, Reading bought three different types to most efficiently handle their metal sawing. A No. 6A machine for production cutting of identical pieces, a No. 4B machine for fast, accurate, miscellaneous cutting, and a No. 8 band saw machine for cutting of structurals, mitering, and other miscellaneous work.

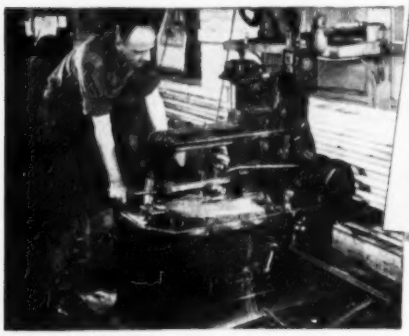
Whatever your metal sawing problem, there is among MARVEL'S 11 different series of sawing machines, a saw or saws that will exactly meet your needs. Your local MARVEL Engineer will gladly study your sawing problems, make recommendations and quote prices.



No. 8 MARVEL Metal Cutting Band Saw. This most versatile saw takes work up to 18" x 18", mortises, miters or roughs to shape.



No. 9A MARVEL Production Saw (world's fastest) automatically feeds, measures and cuts off identical pieces from nested or single bars up to 10" x 10" cross section.



No. 4B MARVEL Hign Speed Saw is a moderate priced, very fast 6" x 6" capacity saw. Here it ideally meets the requirements of the maintenance department.

READING CHAIN and BLOCK CORPORATION

Materials Handling Equipment

READING, PA., U.S.A.

October 24, 1947

Armstrong-Blum Mfg.Company
5700 West Bloomingdale Avenue
Chicago, 39, Illinois

Gentlemen:

We have in our shop three Marvel Saws which are used all day in production work for the cutting of materials in connection with the manufacture of hoists and cranes. Since these three saws have been used in our plant the cost of cutting materials has been greatly reduced, and the speed at which the materials are cut has been increased to such a point that we no longer have "lay overs" due to the lack of materials.

We wish to assure you at this time that when we need more automatic saws in our plant, we will definitely give you first consideration to install the Marvel saws in our plant.

Whenever it has been necessary for any repair service, or engineering service, to be applied to these saws, we have never had to wait or inquire the second time for these services. That is one thing that has kept us in production to this date.

Again assuring you that your services and attentions to our requirements have been very satisfactory, we remain,

Very truly yours,

READING CHAIN & BLOCK CORP.

Fred M. Howard

Fred M. Howard
Purchasing Agent

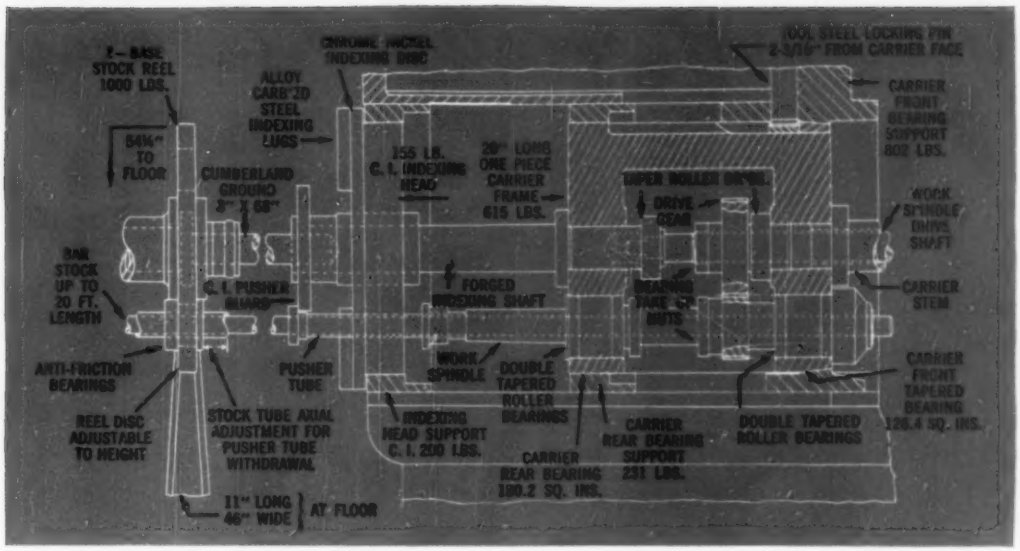
F. Blakh

MARVEL SAWS

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. Chicago 39, U. S. A


2—BASE STOCK REEL 1000 LBS.
CHROME NICKEL INDEXING DISC
TOOL STEEL LOCKING PIN 2-3/16" FROM CARRIER FACE
ALLOY CARB'ZD STEEL INDEXING LUGS
54¼" TO FLOOR
CUMBERLAND GROUND 3" X 68"
155 LB. C. I. INDEXING HEAD
20" LONG ONE PIECE CARRIER FRAME 615 LBS.
CARRIER FRONT BEARING SUPPORT 802 LBS.
DRIVE GEAR
WORK SPINDLE DRIVE SHAFT
BAR STOCK UP TO 20 FT. LENGTH
C. I. PUSHER GUARD
FORGED INDEXING SHAFT
CARRIER STEM
ANTI-FRICTION BEARINGS
PUSHER TUBE
WORK SPINDLE
DOUBLE TAPERED ROLLER BEARINGS
CARRIER FRONT TAPERED BEARING 126.4 SQ. INS.
REEL DISC ADJUSTABLE TO HEIGHT
STOCK TUBE AXIAL ADJUSTMENT FOR PUSHER TUBE WITHDRAWAL
INDEXING HEAD SUPPORT C. I. 200 LBS.
CARRIER REAR BEARING 180.2 SQ. INS.
CARRIER REAR BEARING SUPPORT 231 LBS.
DOUBLE TAPERED ROLLER BEARINGS
11" LONG 46" WIDE AT FLOOR

FIRST THINGS COME FIRST

Upon the Spindle Carrier of an "Automatic" falls the responsibility of accurately presenting and holding the work to — and in contact with — the tools. The basic design of the Carrier is obviously of first importance in the protection of the work spindles from the strain of heavy cuts and weight of the bar stock. Then, in proportion to the Carrier's ability to handle the full load is the importance of any supplementary facility that shares the load.

1. **The 1½" Six Spindle CONOMATIC CARRIER gives better support to the work spindles under heavy loads.**

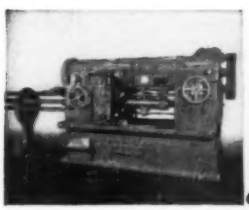
   The thick, heavy ribs resist strain. The tapered front bearing and the spindle drive gears are within 3" and 9¼", respectively, of the collet faces. The wider spaced bearings give better alignment and load distribution. The Carrier is free of Cross Slide positive stop pressure.

2. **The entire INDEXING MECHANISM is supported by the Top Bed as well as the Base. There are fewer wearing parts.**

   The Indexing Head takes the brunt of the indexing load. It is supported by the short frame member midway between the Carrier and the Stock Reel. It is joined to the latter by strong center shafts.

3. **The STOCK REEL is designed to handle longer and heavier loads.**

   The two Stock Reel Bases are independent of the machine and relieve it of the heaviest part of the bar load during the cutting and indexing movements. Adjustable alignment gives freer stock-feed action.



Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

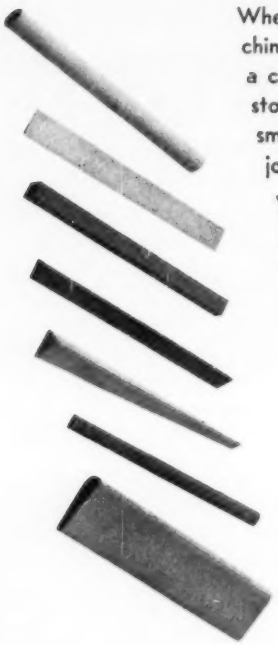
Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

You'll use them all over the shop!

NORTON abrasives

OILSTONE FILES



When you're fitting a die, deburring a machined part or putting that final, keen edge on a cutting tool, the right sized and shaped oilstone file is essential. It lets you get into those small crevices, holes and odd corners to do the job right and in quick time.

You take your pick of more than 200 different sized and shaped INDIA® and HARD ARKANSAS Oilstone Files. *And they're all file*—not just rows of individual teeth to wear down. INDIA electric furnace aluminum oxide is standard for general use, and the natural abrasive—HARD ARKANSAS—is the choice for final finishes and real precision work. *Only Behr-Manning offers this complete line of Natural as well as Manufactured Stones.*

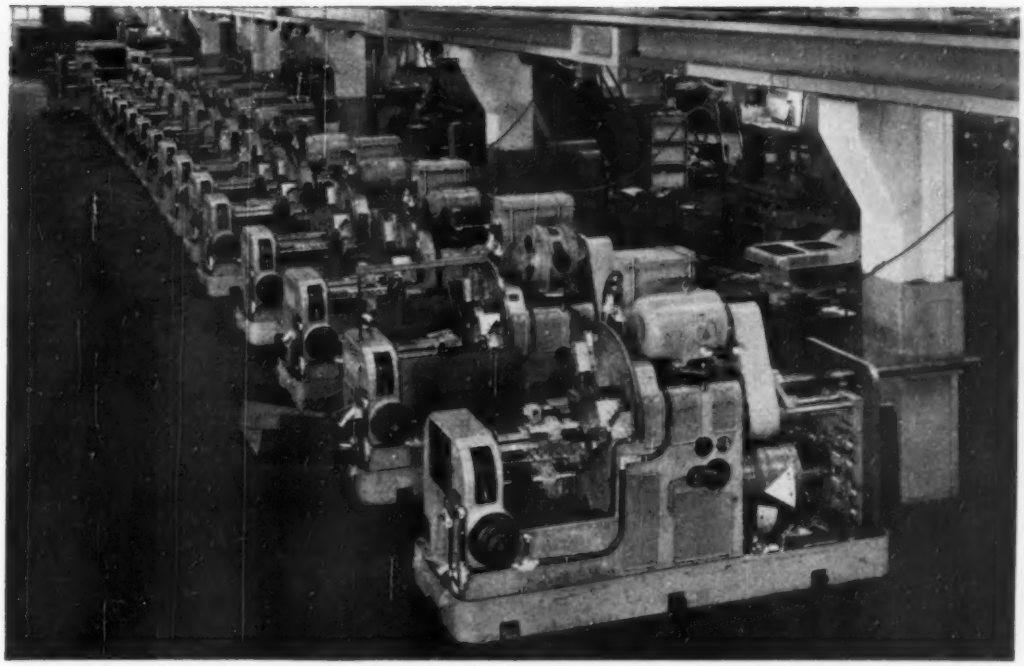
These descriptive folders tell the whole story. Write for them today. Address Dept. AM-11.

BEHR-MANNING

BEHR-MANNING

TROY, N.Y.

ALSO COATED ABRASIVES FOR EVERY INDUSTRIAL NEED



16 MORE PROOFS OF POPULARITY!

If our salesmen are forced to tell you that our new Acme-Gridley Model M Single Spindle Automatic is so popular we can't keep up with demand, it's no idle boast. The machine sells itself faster than we can build them—and we're building them at top speed, in large lots, as evidenced by this recent photograph of one of our assembly lines.

Here are some of the reasons why our customers are buying Model M's for faster (*up to 10 times faster*) production of gear blanks, bearing races and similar parts:

- **Eight Independently Operated Tool Slides—permit use of speeds and feeds best suited to each cut, using carbide or high-speed cutting tools.**
- **Three Automatic Spindle Speed Ranges—provide correct surface speed for a wide range of diameters.**
- **Easily Accessible Camming—minimizes change-over time on small-lot setups.**
- **Turret Indexes Independently—several short end operations can be performed while heavy forming cuts are being made from the side slides.**
- **Rugged, Open Frame—strength to take full advantage of carbide tools, yet plenty of room for chip clearance and easy tool adjustment.**

If these add up to the kind of time-saving, money-saving features you need in a simple, yet versatile, fully automatic single spindle machine, we'll be glad to send you more details—(and we'll name machine deliveries just as early as material supplies for our stepped-up production schedule allow).

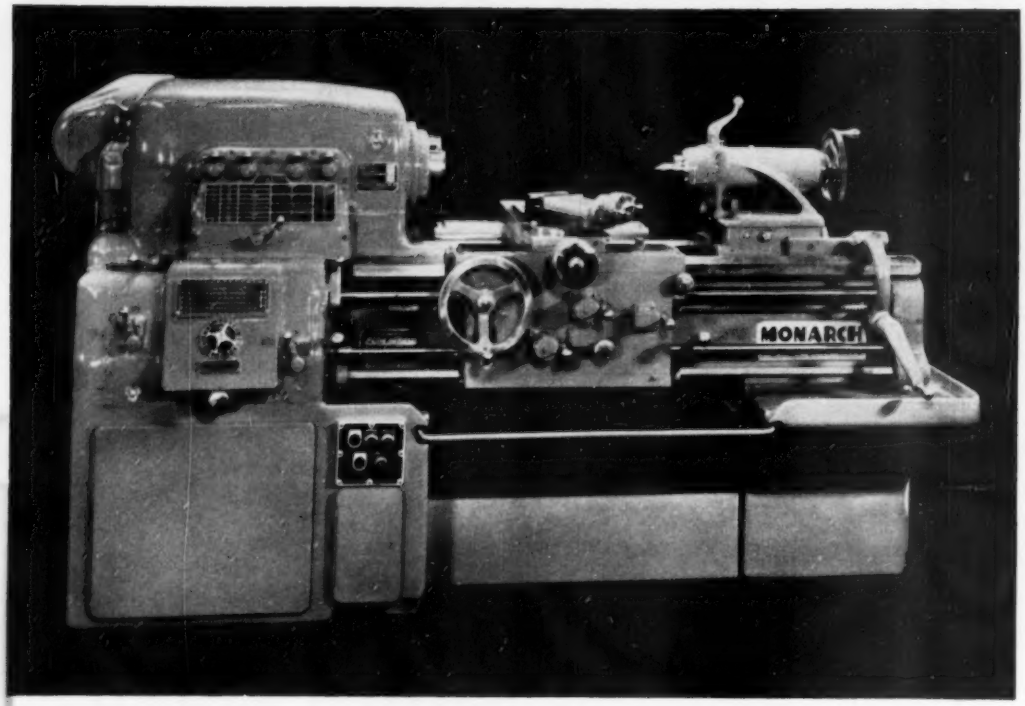
The New Acme-Gridley Model M Single Spindle Automatic Bar, built in sizes 2⅝", 3½", 4¼", and 5½", is completely illustrated and described in this new Catalog M-50.

Formula for profit leadership: Don't wait for your competitors before you discard obsolete machining methods.

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing



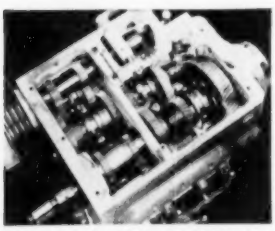
PRECISION POWER WHERE IT COUNTS —at its best on Series 60 Lathes

You'll get peak power—and long life at original accuracy in the—headstock of every Series 60 Lathe. Its extremely efficient design is characterized by two outstanding features, both pioneered by Monarch.

First, is the use of helical gears—all made of hardened alloy steel, and with ground or shaved tooth contours. The result is quieter, more efficient operation, with less waste power, less wear (and, as a result less down time).

Equally important is the extra-wide design of the Series 60 headstock gears. Not only is there more tooth contact at all times, providing more efficient transmission of power—but shifting is easier and faster (with less gear wear) by means of clutches instead of shifting the gears themselves.

An almost integral part of Monarch's superior headstock design is the American Standard Camlock Spindle Nose—a distinct advantage because of easier, faster, more rigid, more accurate mounting of chucks and fixtures.



Monarch Series 60 Headstock Gearing

These and many other design and construction features mean more savings with Monarch's Series 60 Machines, available in 14", 16" and 20" sizes. For complete information ask for Booklet 1113.

You'll Save on Maintenance and Operating Expense With These Series 60 Features:

1. Totally-enclosed gearbox and end gearing—preserves accuracy.
2. Automatic pressure lubrication—insures long life at original efficiency.
3. All anti-friction bearings—for peak power and less maintenance.
4. Hardened, ground or shaved, wide helical gears in headstock—for precision power, easier shifting.
5. American Standard Camlock Spindle Nose—for quick, rigid chuck and fixture mounting.
6. Flame-Hardened and Ground Bedways—preserves accuracy—proved on over 25,000 Monarch Lathes.
7. Induction hardening of many critical parts—for long, trouble-free life.

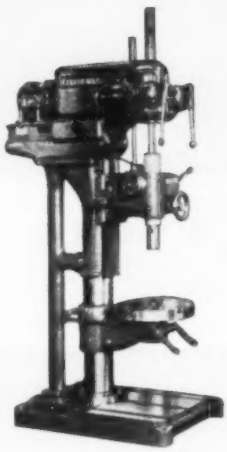
ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO

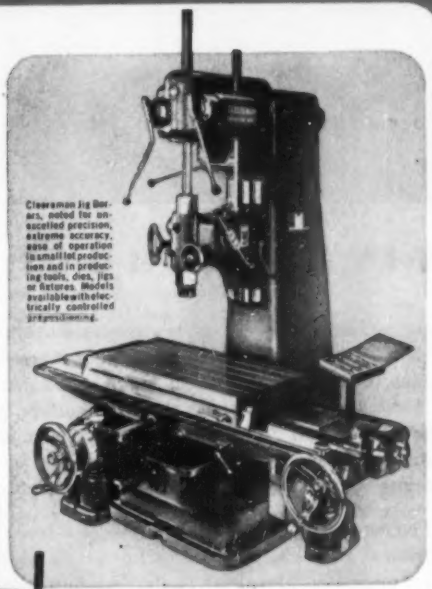
THE CLEEREMAN LINE

OF PRECISION JIG BORERS and DRILLING MACHINES

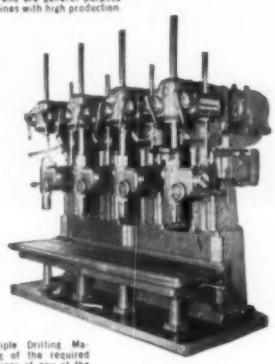


Cleereman Round Column Drilling Machines produce accurate holes at high speed and at low cost and are general purpose machines with high production.

Cleereman Model 325 Single Unit Sliding Head Drilling Machines combine extreme sensitivity with rugged construction, are extremely versatile and may be used for production drilling and tapping.

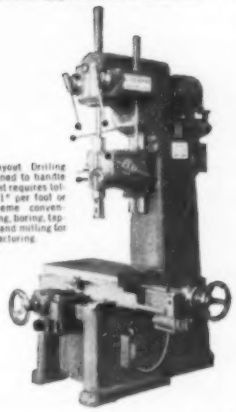


Cleereman Jig Borers, noted for unexcelled precision, extreme accuracy, ease of operation in small lot production and in producing tools, dies, jigs or fixtures. Models available with electrically controlled [illegible].



Cleereman Multiple Drilling Machines consisting of the required number of machines of any of the three types supplied to meet individual requirements.

Cleereman Box Column Drilling Machines have an exceptionally rigid construction for continuous heavy duty work combined with accuracy and the speed required for low cost production.



Cleereman Layout Drilling Machine designed to handle layout work that requires tolerances of .001" per foot or broader. Extreme convenience for drilling, boring, tapping, reaming and milling for jigless manufacturing.

BRYANT Machinery & Engineering Company

General Office
400 West Madison Street, Chicago 6
Representatives in Principal Cities

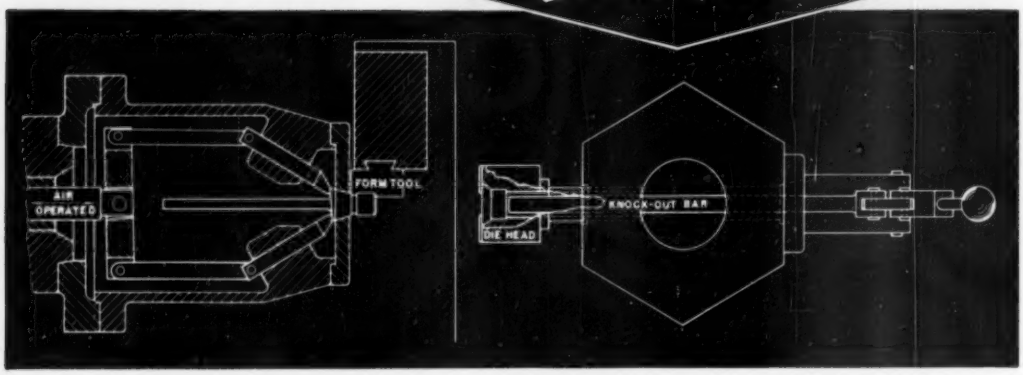
Affiliated with—

CLEEREMAN MACHINE TOOL CO. Green Bay, Wis.

BUILDERS OF PRECISION JIG BORERS & DRILLING MACHINES

YOU CAN USE IDEAS

Like This

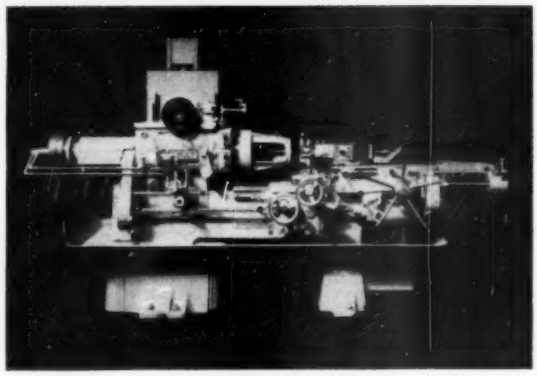


WITH GISHOLT TURRET LATHES

Here's a turbine blade job. It is a tough job to hold because not only are there a number of different blades, each of different length, but the work must be located and held against a tapered surface. It requires a special fixture. An air-operated plunger through the spindle forces the taper against the locating seat on the fixture, holding all sizes firmly.

The machining is done on the shank end. It must be turned and faced and necked for thread relief. Form tools on the rear of the cross slide handle all this in a single pass. Threading is done from the turret and a hand-operated knock-out bar loosens the blade from the fixture after the threading is completed. Production is more than adequate to meet the contract requirements.

This kind of investment pays off handsomely. If you are looking for practical, cost-cutting ideas, why not let Gisholt engineers help you. They have been specialists in turret lathe work for over 60 years.



Gisholt lathes are ideal for high speed work of this kind. With hydraulic spindle control, the Gisholt Speed Selector, and many other automatic features, operating time and effort are reduced to a minimum. Ask for literature.

GISHOLT MACHINE COMPANY
MADISON 10, WISCONSIN

GISHOLT

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

There's a **UNION** *twist drill for top performance on every operation!*

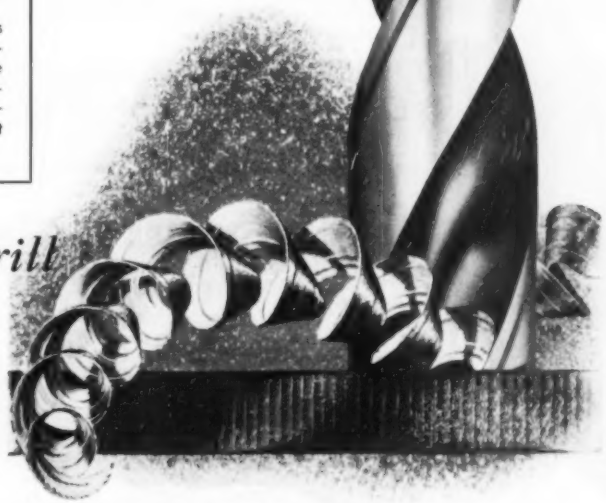
Whether you're working on the hardest alloy steel or softest iron . . . on such nonferrous metals as brass, copper, aluminum, magnesium or zinc . . . on slate, marble, rubber, plastics, wood or any other nonmetal . . . there's a type of Union Twist Drill that will give you tops in accurate, trouble-free, money-saving performance.

That goes, too, for a normal working pace or for high production records . . . and for every type of drilling equipment. No matter what the material or the conditions, *you're sure of best results when you specify Union!*

Union Twist Drills, Straight and Taper Shank High Speed Steel, with Blue Oxide Surface Treatment.

SERVICE THAT SAVES YOU TIME, TROUBLE, MONEY

Union Twist Drills are made in designs that cover the broadest range of operations. To aid you in choosing exactly the right type and size of drill for your particular applications — usual or unusual — your Union service man offers expert assistance. Call on him any time.



no other twist drill will outperform a **UNION**

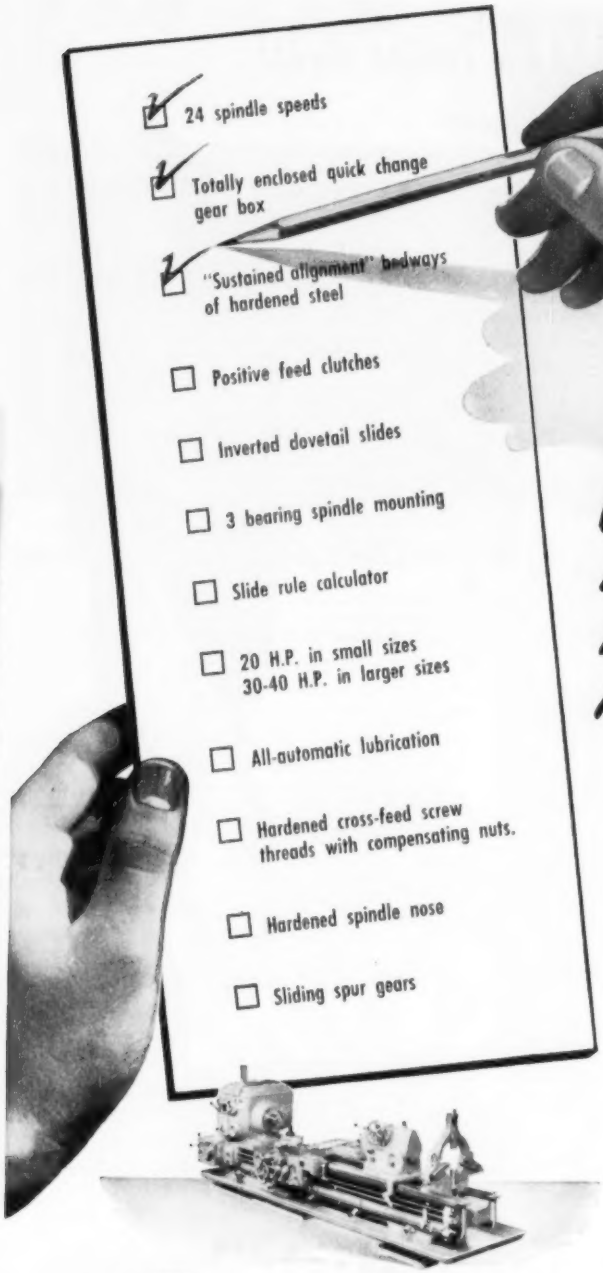
contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under "Drills, Twist."

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.


24 spindle speeds
Totally enclosed quick change gear box
"Sustained alignment" bedways of hardened steel
Positive feed clutches
Inverted dovetail slides
3 bearing spindle mounting
Slide rule calculator
20 H.P. in small sizes
30-40 H.P. in larger sizes
All-automatic lubrication
Hardened cross-feed screw threads with compensating nuts.
Hardened spindle nose
Sliding spur gears

Will your new lathe have all these important features?

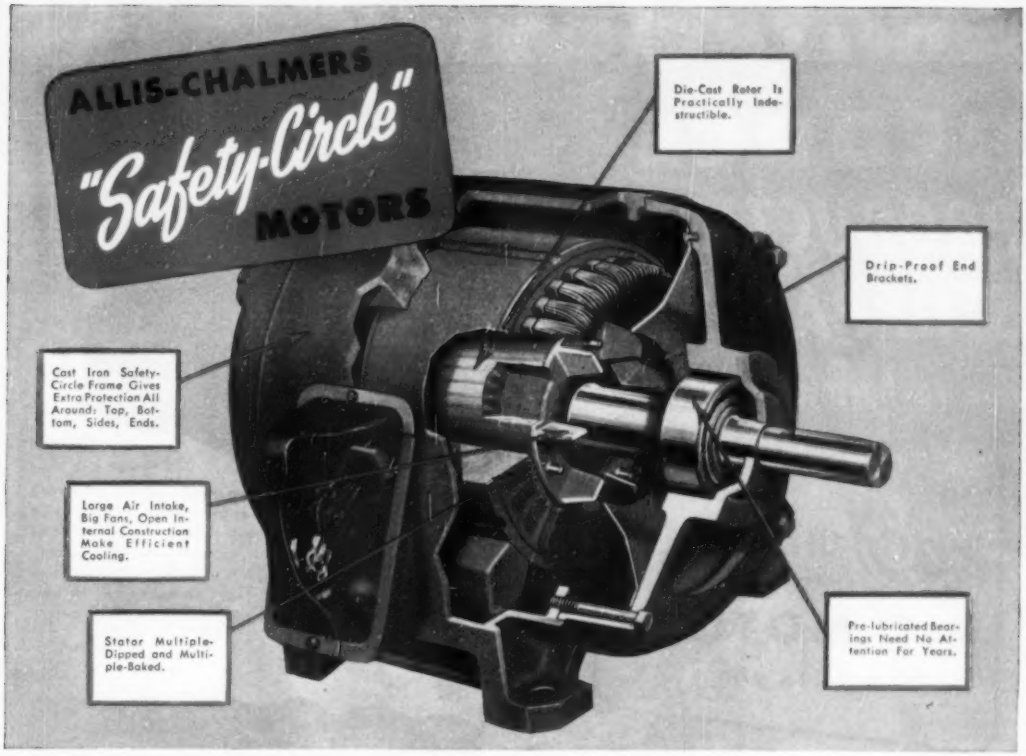
Use this check list to insure Profitable Performance...

When you buy a new lathe compare all the *important* features. If any of these features are absent you're not getting all the value your money can buy. Check your old lathes, too, against these 12 necessary features. You are probably losing money if they lack any of these latest advantages.

Many of the features shown here are exclusive with Lodge & Shipley, others are not. But—no other lathe—only the Model "X" combines ALL these profit-making advancements.

For detailed information, write today for NEW "Features Catalog #200." Tells you *what* each feature is, *how* it improves or speeds operation and *why* it's important to you. Write, also, for a supply of Check Lists to make your lathe comparisons.

THE **Lodge & Shipley** COMPANY
MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO


ALLIS-CHALMERS
"Safety-Circle"
MOTORS
Die-Cast Rotor Is Practically Indestructible.
Drip-Proof End Brackets.
Cast Iron Safety-Circle Frame Gives Extra Protection All Around: Top, Bottom, Sides, Ends.
Large Air Intake, Big Fans, Open Internal Construction Make Efficient Cooling.
Stator Multiple-Dipped and Multiple-Baked.
Pre-lubricated Bearings Need No Attention For Years.

HOW SAFETY-CIRCLE

Means Motor Dependability

EXTRA PROTECTION means extra dependability. That's why Allis-Chalmers protects the working parts of the motor with the exclusive *SAFETY-CIRCLE*. Compare this motor with motors of less rigid construction. The *SAFETY-CIRCLE* motor will not distort in mounting or under strain. And you get the extra protection of drip-proof end brackets at no premium.

EXTRA PROTECTION INSIDE, TOO

Stator is multiple-dipped and multiple-baked in special insulating varnish. Rotor is die-cast aluminum. Stator is mounted in four longitudinal ribs which leaves plenty of air space between stator and frame. Large fans cast integrally with the rotor and ample air intakes keep temperatures well within rated limits. *Ball bearings are factory-lubricated and require no further attention for years.*

When you shop for motors, remember *SAFETY-CIRCLE* gives you *extra protection, extra dependability* and *lower operating costs.*

For details on *SAFETY-CIRCLE* advantages, see your A-C Authorized Dealer or Sales Office or write for Bulletin 51B6210B. Sizes 1 to 20 hp, 326 frames and smaller. *Safety-Circle, Texrope* and *Vari-Pitch* are Allis-Chalmers trademarks. A-3146

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Sold . . .
Applied . . .
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by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

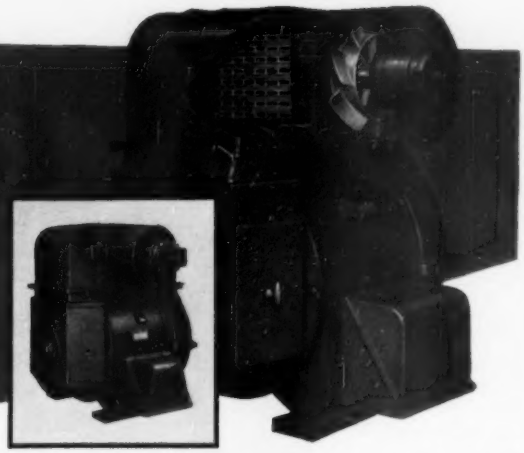
CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ½ in. to 72 in. discharge and up.

REDUCE PRODUCTION STOPPAGES

due to harmful atmospheres



Single-blower type for normal speed operation In this standard G-E motor, the unit cooler consists of alternate air passages placed at right angles to each other. Clean motor air, kept in motion by a fan on the main motor shaft, circulates through one set of passages in an enclosed system. Cool outside air, drawn into the cooler by a blower separately motor-driven, flows through another set of passages and absorbs the heat from the internal air stream. Motor air, never in contact with contaminated outside air, is always clean.

UNIT-COOLED

D-C MOTORS

from 15 to 200 hp

Reliable Performance . . . dust, dirt, dampness, metal particles, or oily vapors can't affect the operation of these General Electric standard, totally-enclosed, unit-cooled d-c motors.

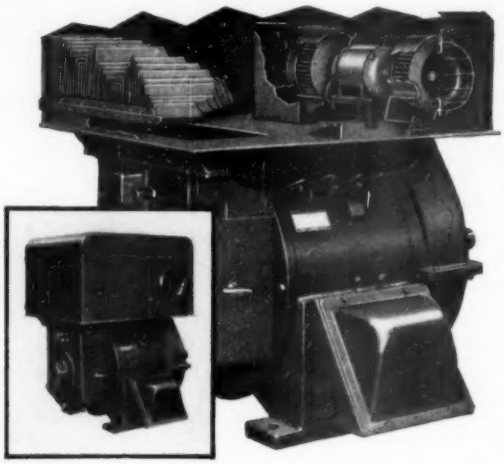
Fewer Inspection Shutdowns . . . windings, brushes, and brush rigging are kept clean at all times because motor air never comes in contact with contaminated outside air.

Reduce Power Cost . . . because motor heat is rapidly dissipated, power consumption is less, especially in wide-range adjustable-speed motors.

Simplify Maintenance . . . large openings in the commutator end shield make it easy to get at commutator, brushes, and brush rigging.

Save Mounting Time . . . interchange of motors to meet changing plant conditions takes less time because G-E totally-enclosed motors have the same mounting dimensions as G-E open motors of the same ratings.

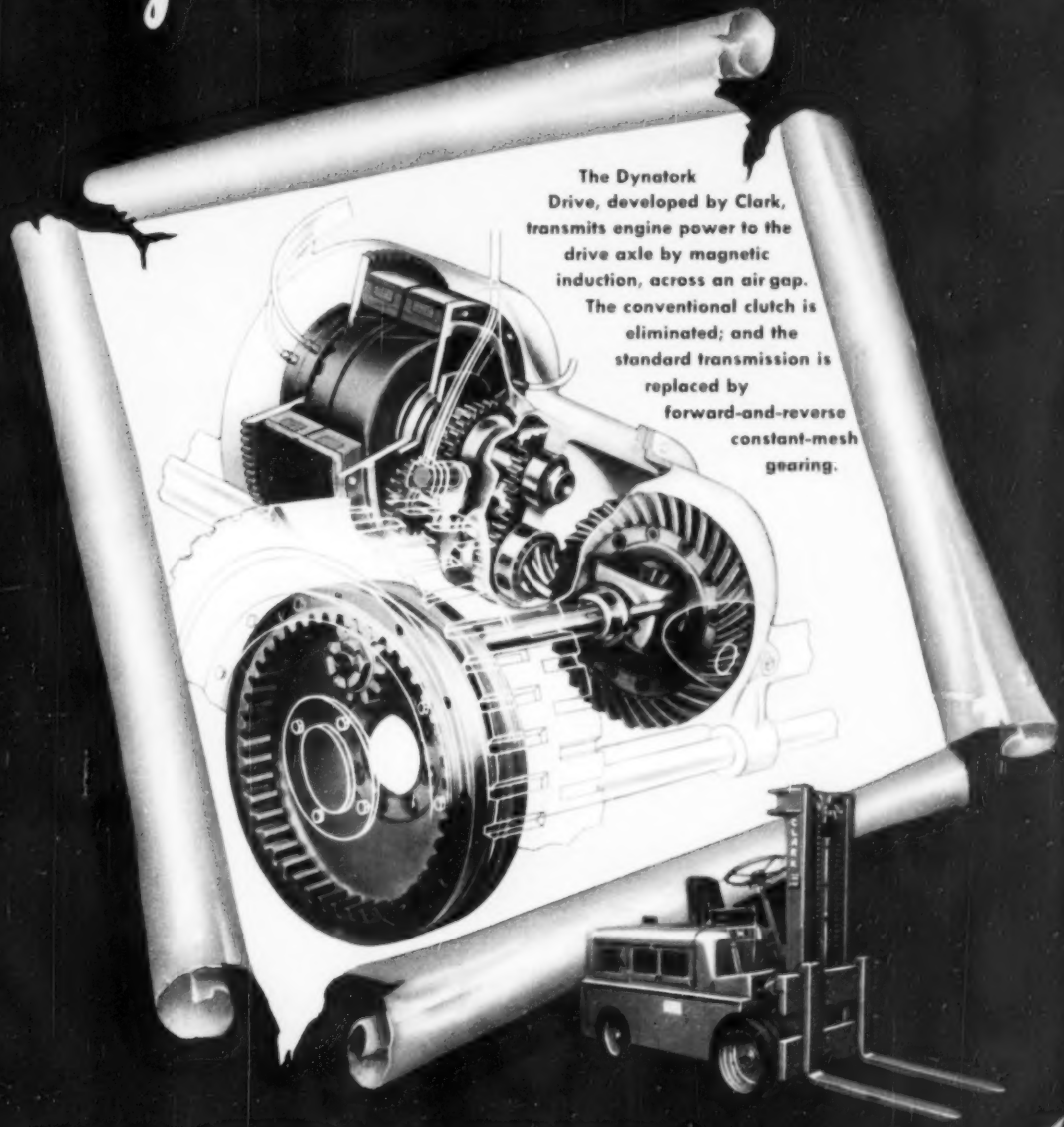
Get The Whole Story . . . ask your G-E representative how these sturdy, protected motors can increase production and trim operating costs in your plant, or send for Bulletin GEA-4469. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



Double-blower type for continuous low speeds New—a totally enclosed standard G-E motor that can't run a fever! Without danger of overheating, it delivers full torque continuously, even at very low speeds. Key to its operation is a new development—ventilation entirely independent of motor speed. Two blowers, mounted on opposite shaft extensions of a single auxiliary motor running at constant speed, provide full ventilation at all times. One circulates internal air and the other external air through alternate vertical passages.

GENERAL ELECTRIC

CLARK Dynatork Drive



The Dynatork Drive, developed by Clark, transmits engine power to the drive axle by magnetic induction, across an air gap. The conventional clutch is eliminated; and the standard transmission is replaced by forward-and-reverse constant-mesh gearing.

Available on UTILITRUCS 6000, 7000, 10,000 lbs.
CARLOADERS 3000, 4000, 5000 lbs.
and YARDLIFTS, 4000, 6000 lbs.

TURN PAGE FOR MORE DYNATORK DETAILS

CLARK EQUIPMENT COMPANY, INDUSTRIAL TRUCK DIVISION
BATTLE CREEK, MICHIGAN

PAG
MISS

GES

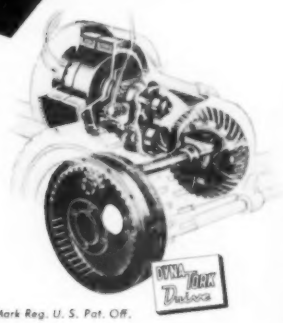
SING

DYNATORK DRIVE *Makes a Better* CLARK CARLOADER!

FASTER! *from forward to reverse* ***IT DOES MORE WORK!***

EASIER! *to operate than your car* ***IT DOES MORE WORK!***

BETTER! *neutral tests prove* ***IT DOES MORE WORK!***



*Trade Mark Reg. U. S. Pat. Off.

Here's a combination destined to make Materials Handling history—

The husky and versatile gas-powered Carloader fork-lift truck of 3,000-, 4,000- and 5,000-lbs.-capacities has done more than any other one model to establish Mechanized Materials Handling as essential to modern high-speed, low-cost production.

The revolutionary Dynatork Drive cuts deeply into handling costs *by increasing as much as 20 per cent the amount of work a fork truck can do.* It transmits engine power to the drive wheels by magnetic induction, through an air gap—no clutch, no conventional transmission. It's unique because it does not have to be brought to a stop before reversing.

This combination of CARLOADER* and DYNATORK* DRIVE constitutes a forward step of enormous significance to the science of Materials Handling. You'll want to know all about it. A Clark bulletin will bring you the facts in convenient form. Write for it.

CLARK ELECTRIC AND GAS POWERED FORK TRUCKS AND INDUSTRIAL TOWING TRACTORS

INDUSTRIAL TRUCK DIVISION • CLARK EQUIPMENT COMPANY • BATTLE CREEK 66, MICH.

Please send: ☐ Literature on Carloader with Dynatork Drive ☐ Movie Digest ☐ Material Handling News

Name_____

Firm Name_____

Street_____

City_____ Zone____ State_____

AUTHORIZED CLARK INDUSTRIAL TRUCK PARTS AND SERVICE STATIONS IN STRATEGIC LOCATIONS

PRODUCTS OF CLARK—TRANSMISSIONS • FORK TRUCKS & TRACTORS • AXLE HOUSINGS • GEARS AND FORGINGS • RAILWAY CAR TRUCKS • ELECTRIC STEEL CASTINGS • AXLES • TRACTOR UNITS

PRINTED IN U.S.A.

ARMSTRONG
TOOL HOLDERS...
for the toughest steels!

The "Armstrong System" provides special ARMSTRONG TOOL HOLDERS for ARMALOY (cast alloy) and for ARMIDE (carbide-tipped) cutters. With these modern cutting tools, the toughest and hardest steels are easily machined. Far heavier feeds and the extremely high cutting speeds become practical (300 f.p.m. with ARMALOY cutters; 600 f.p.m. with ARMIDE cutters). Delays for tool re-grinding are reduced to an absolute minimum—edges hold up to 100 times as long.

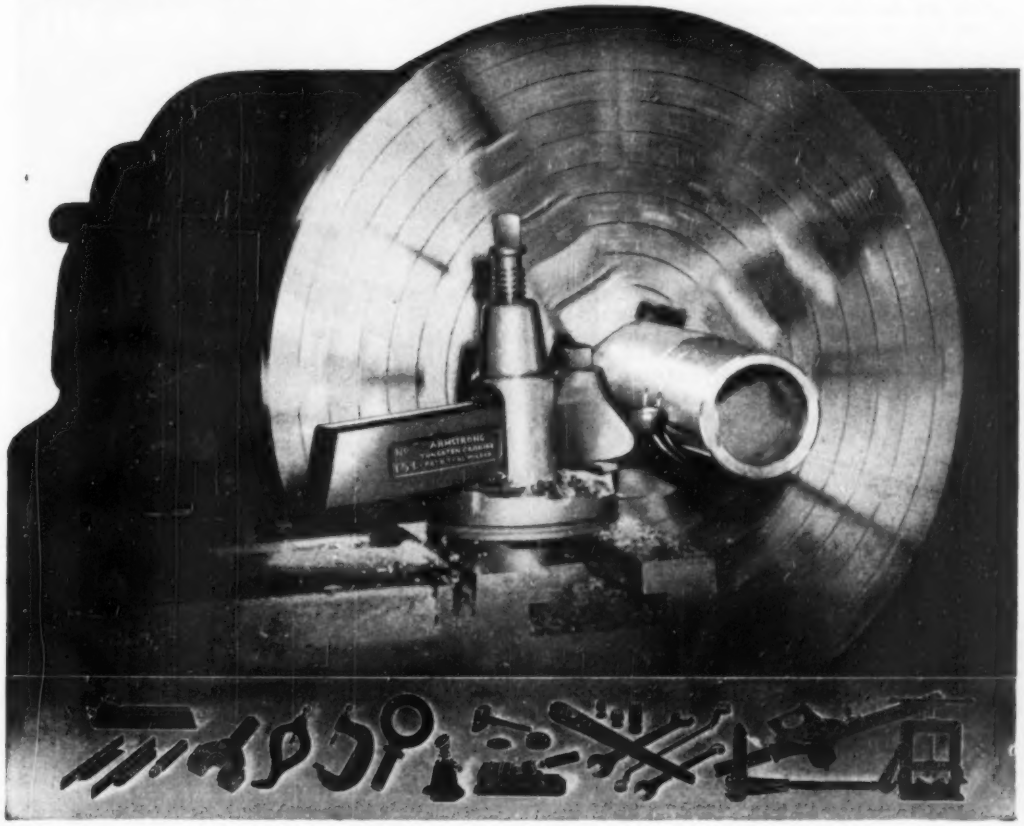
These new tool holders and cutters are stocked by your local ARMSTRONG industrial distributors.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

WRITE FOR CATALOG

5215 West Armstrong Ave. **Chicago 30, U.S.A.**



Now...Walker-Turner **design** helps you make sharper cuts in production costs!

New 16" Band Saw...

Seldom are the cost-cutting advantages of Walker-Turner design so *clear-cut* as in this new 16" metalworking band saw. Take, for example, its three-piece frame and body construction. The greater rigidity and accuracy, the smoother operation this affords, means more production per operator and longer machine life.

But where the efficiency of this production machine really shows up is in operating savings. A patented Automatic Feeding Mechanism for straight or irregular cutting positively prevents overloading the blade . . . greatly prolongs blade life.

Here, in short, is a metal-cutting machine designed for profitable operations. Put the new Walker-Turner 16" Band Saw to work in your shop, and watch how it speeds cutting and cuts production costs. Catalog describes fully this and other machines in Walker-Turner's complete line of power tools for metal and woodworking operations. Mail coupon for your copy.

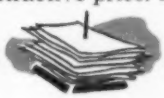
SOLD ONLY THROUGH AUTHORIZED DEALERS

Walker-Turner Division, Kearney & Trecker Corp.
Dept. AM-11, Plainfield, New Jersey
Please send me the new Walker-Turner Machine Catalog.
Name.....
Title.....
Company.....
Address.....
City..... Zone..... State.....

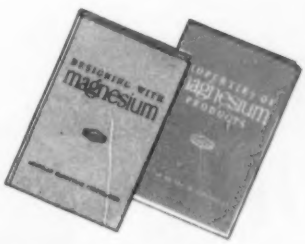
WALKER-TURNER
• DIVISION •
KEARNEY AND TRECKER CORPORATION
PLAINFIELD, N. J.

DRILL PRESSES • RADIAL DRILLS • TILTING ARBOR SAWS • BELT and DISC SURFACERS
LATHES • METAL-CUTTING BAND SAWS • SPINDLE SHAPERS • JOINTERS

Ticklish Business

Sales of this company's movie projectors weren't humming like they should. The boss needled his designers for a new portable design. First requirement was light weight . . . then strength . . . low production costs and a buy-on-sight price tag. The designers suggested an all-magnesium model. "We don't know how to machine magnesium, it might be ticklish business," said the boss. But the designers had the facts from light-metal headquarters, Aluminum Company of America. They showed the boss that simple procedures make handling magnesium easy. They showed him how other manufacturers were making better products with magnesium. (Using over three million pounds every month). They had books on designing and fabricating magnesium that convinced him that magnesium was the lightest and fastest machining of all commercial metals. Now the frames are cast in Alcoa foundries at a very attractive price. Easier machining and handling sliced production costs. The dealers keep ordering  more and more.

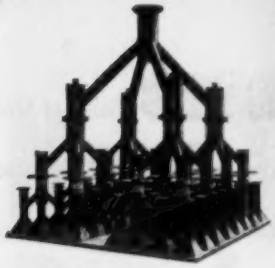
These two free books on magnesium and our broad technical knowledge can improve your products, too. Write Aluminum Company of America, 2106L Gulf Building, Pittsburgh 19, Pa. Sales offices in principal cities.



ALCOA

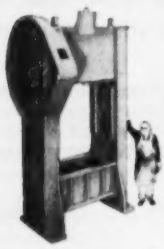
ALCOA ALUMINUM and MAGNESIUM

Steel-Weld FABRICATION

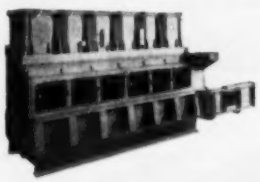


One of Several Parts of a Catalytic Cracking Plant Produced for the Petroleum Industry.

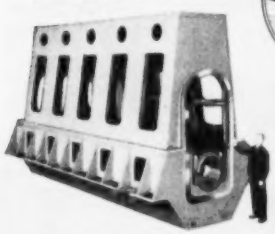
Pressure Vessels for the Chemical and Allied Industries.



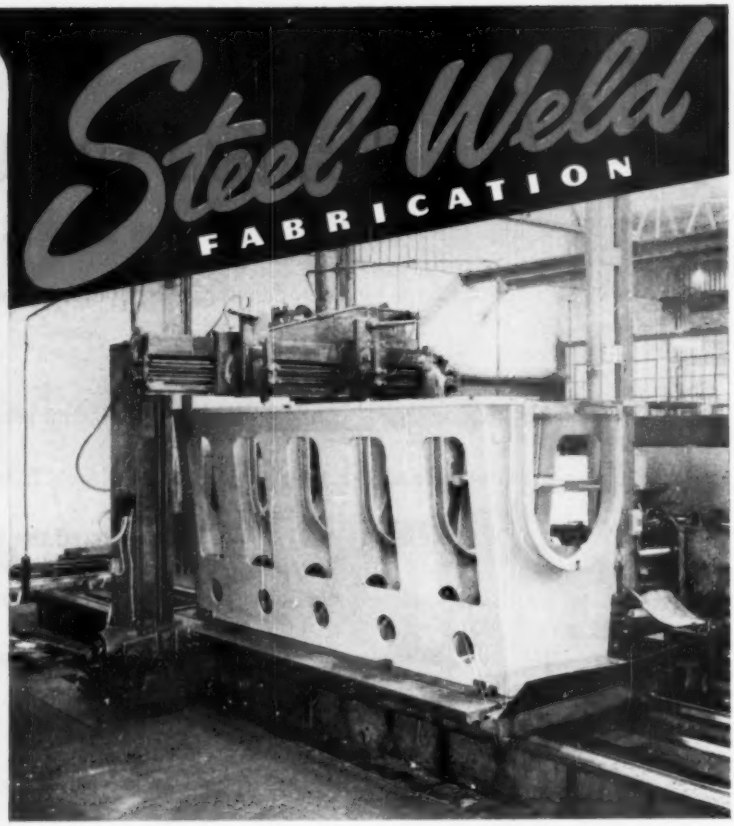
Heavy Press and Machine Frames and Bases for the Machine Tool Industry.



Diesel Engine Crank Cases and Frames for the Marine and Electro-Motive Field.



Crank Cases, Frames, and other Parts for Manufacturers of Marine Steam Engines of Uniflow or Multiple Expansion Type.



This massive Marine Engine Frame was Steel-Weld Fabricated and completely machined ready for assembly by the Steel-Weld Division of The R. C. Mahon Company.

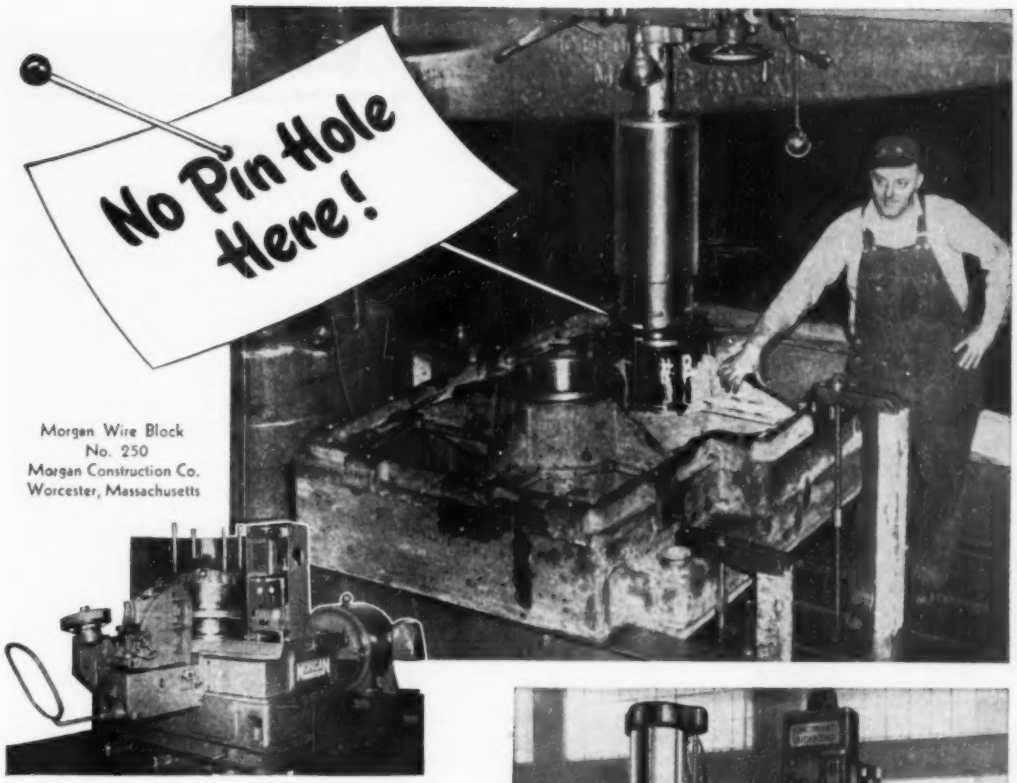
Today, many parts and major assemblies of heavy machinery and equipment are economically produced in welded steel . . . units illustrated on this page are typical of thousands of Steel-Weld Fabricated parts produced by Mahon for manufacturers throughout the country. If your product—or parts of it—lends itself to this production technique, you will find savings in time and cost through Steel-Weld Fabrication. If you investigate, you will also find in the Mahon Company an unusual source for welded steel in any form for any purpose . . . a source with complete, modern fabricating and machining facilities, backed by a staff of competent design engineers and craftsmen from whom you may expect a smoother, finer appearing job, embodying every advantage of Steel-Weld Fabrication.

THE R. C. MAHON COMPANY

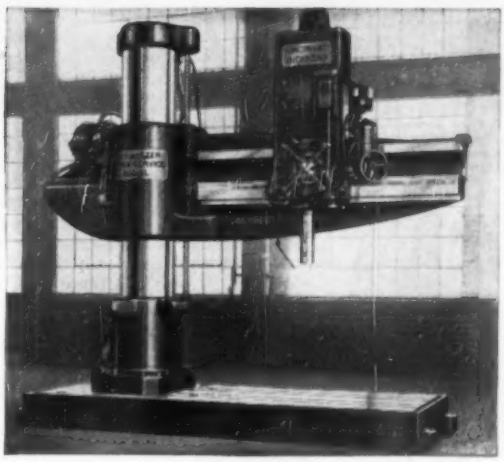
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

MAHON



Morgen Wire Block
No. 250
Morgan Construction Co.
Worcester, Massachusetts



If your work is big, the Cincinnati Bickford Master Super Service Radial offers the power and rigidity that are definitely required. It is easily operated, and the centralized controls answer to a touch.

Highly accurate, with capacities far in excess of what today's cutting tools will stand, it handles unusually large castings economically and efficiently.

The 26" column, 12' arm, with forty horsepower, constant speed motor, is one of the largest Radial Drills built.

If your work is big—write for Bulletin R-22.

Our 75th Year
CINCINNATI BICKFORD
1874-1949
METAL DRILLING MACHINERY
SUPER SERVICE

THE CINCINNATI BICKFORD TOOL CO.

Equal Efficiency of Every Unit Makes the Balanced Machine

Cincinnati 9, Ohio U.S.A.

CROSS UNIVERSAL GEAR MACHINES

for

- ROUNDING
- CHAMFERING
- POINTING
- BURRING

Cross Universal Gear Machines embody advanced engineering developments to obtain highest productivity and assure lowest possible operating costs.

They feature utmost flexibility for handling a wide variety of gears. Continuous cutting motion, exclusive with Cross, speeds production at top efficiency.

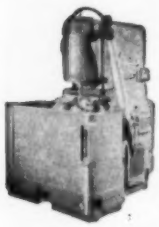
Special skill is not required because machines are automatic and push button controlled. Power clamping is foot pedal controlled. Both hands are free for work handling.

No. 55

For rounding, pointing, chamfering or burring external and internal:

spur gears
helical gears
clutches
splines

Typical productivity when rounding or pointing 8 pitch 30 tooth gears is 55 per hourly.



No. 65

For pointing or chamfering external and internal:

clutches
spur gears
bevel gears
splines

Typical productivity when pointing 10 pitch 30 tooth gears is 100 per hourly.

No. 75

For burring or chamfering both ends at the same time.

helical gears
spiral bevel pinions
hypoid pinions

Typical productivity when chamfering 8 pitch 40 tooth gears is 200 per hourly.

THE **CROSS** COMPANY
Established 1898

SPECIAL MACHINE TOOLS
MILLING • DRILLING • TAPPING • BORING
TURNING • SHAPING • GRINDING • HONING

DETROIT 7, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Diamond Shaping

Shortly after World War I, the Marmon Automobile Co. did a lot of experimenting with diamond tools. On one visit, the superintendent showed me the finishing of cylinder bores with diamond tools. Here too was the first and only time I have ever seen diamond tools used in shaping. The Marmon bearing cap fitted into a recess in the crankcase-bearing support. This held it firmly in place and did not depend on the bolts for anything except to hold the cap against the bearing itself. At the time of my visit the ends of these cast-iron bearing caps were being finish-machined in a shaper with a special tool carrying two diamonds, set at just the right distance apart to make the bearing cap of the exact length wanted. I have no data on the time required or the cost of the diamond tools, but the superintendent felt that the accuracy secured warranted the cost of the tools and the time required for the job.

Another unusual job in the early days of the Canadian Model T Ford was the shaping of the contours of the cams on the camshaft. A special fixture held the camshaft and rotated it slowly while the shaper tool went back and forth across the face of each cam. The fixture not only turned the camshaft but moved away from the tool and back again to produce the desired cam. I am under the impression that this was not standard practice for very long.

Fred H. Colvin
Point Pleasant, N. J.

1880-1917 AM

I have bound volumes of the *American Machinist* covering the period 1880 to 1917, both years inclusive. Issues for the years 1880 to 1895 are bound in ¾ leather and contain advertisements, while those from 1896 to 1917 are bound in cloth, without ads; a total of 50 volumes—all in very good condition.

In addition to the above, I also have: "Modern Machine Shop Practice" by Joshua Rose, ME (1888) 2 vol., ¾ morocco; "Machinery's Encyclopedia—1917," 6 vol., "Index & Guide to Systematic Reading"—¾ morocco.

We are moving to Florida and are anxious to dispose of these volumes.

J. C. Zenobia
c/o Erie Railway Company
Chambers Street Terminal
New York 7, N. Y.

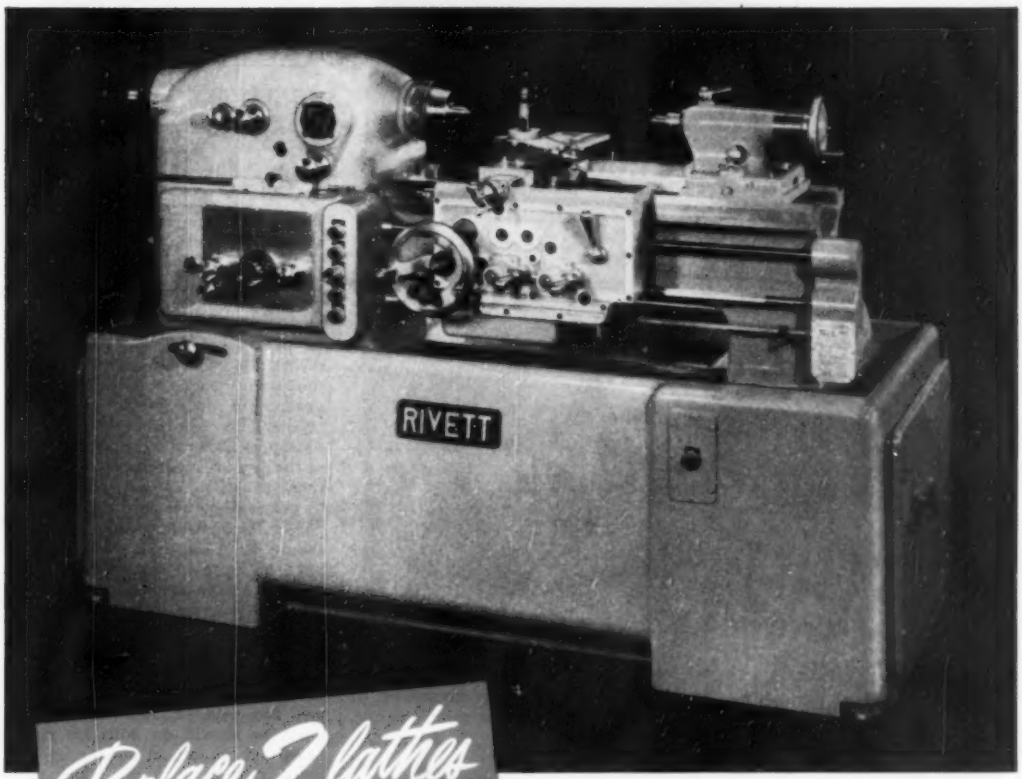
Dye Footprint

The author's suggestion in *AM*, Oct. 2, 1950, for measuring the helix angle is good, but it should be noted that the helix angle measured by this method is that on the outside diameter and not on the pitch diameter which is the angle required for subsequent calculations and machine settings. However, from the measured helix angle at the outside diameter, the measured outside diameter, the normal diametral pitch, and the number of teeth the helix angle at the pitch diameter can be obtained by simple calculations:

Let D_o = measured outside diameter
d_o = measured helix angle at outside diameter
a_p = measured helix angle at pitch diameter
N = number of teeth
P_n = normal diametral pitch
L = lead of helix
$L = \pi D_o \cot a_o$

$$\sin a_p = \frac{N\pi}{PL}$$

Carl A. Johnson
Springfield, Mass.



Replace 2 lathes in your shop—

. . . with this new RIVETT 1020S TOOLROOM LATHE

RIVETT 1020S has what it takes to make an outstanding lathe!

■ 40% heavier than comparable lathes. Weighs 4000 lbs. ■ Back gearing for power cuts—belt drive for high speed. Range from 22 to 3600 R.P.M. ■ 12¾" wide hardened steel ways of bed absorb heavy cutting force. ■ High spindle speeds through mechanical drive. ■ Push button controls for complete operation. ■ Neutral clutch stops spindle without stopping drive. ■ Three bearing mounts for spindle. ■ Collets mount directly in spindle. ■ Hand wheel for turning headstock spindle. ■ Anti-friction bearings used throughout. ■ Gear box gives 72 feeds and 84 threads from 2 to 240 per inch. ■ Automatic lubrication. ■ Hardened and ground feed screws.

No need to have both an instrument lathe and an engine lathe when this new Rivett 1020S combines the features of both! Here you get feather-touch sensitivity at 3600 R. P. M.—or the ruggedness for a ¼" cut at .020" feed in cold rolled steel. It qualifies for any work within its 12½" swing and 20" centers.

The beauty of this amazing machine will delight the heart of any tool man. Look at the features listed here and then *get all* the facts on what makes the 1020S the outstanding lathe investment. **Write for Bulletin No. 1020A.**

RIVETT

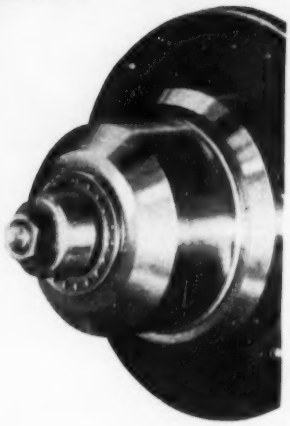
LATHE & GRINDER, Inc.

Dept. AM R11 Brighton 35, Boston, Massachusetts

For More Precision Work *RELY ON RIVETT LATHES AND GRINDERS*, The Master Craftsman's Master Tools

HERE'S the POINT

that's bringing greater speed, versatility and economy to **THREADING JOBS!**



Handles any thread profile up to 6" external—4" internal!

Average price of threading tool $3.20!

Speedy, 15 minute changeover!

Outmodes former threading methods!

Do you have Cri-Dan Bulletin 75-A?
Why not contact your Lees-Bradner representative?

The LEES-BRADNER Company
CLEVELAND 11, OHIO, U.S.A.

One Best Way

One of our English friends objects to my criticism of the "one best way" and calls attention to the wild variety of tool shapes that men left to themselves would produce. In my dictionary, however, the "one best way" does not refer to the tools as much as to the method of using them. In the old shop where I learned the trade, each man forged and ground his own lathe tools. Some of them are fearful and wonderful examples of how not to do it. But at the 16-fpm cutting speed for steel then in use, it may not have made as much difference as might be supposed. I do not mean that each man should grind his tools or forge them, but I do mean he should be permitted to use them in his own particular way if it does not interfere with the quality of the work or the time required to do it.

What used to anger the old machinist in the early days of "system" was the detailed instruction as to what he should do with his right hand and his left, in picking up the work, putting it in the chuck and so on in minute detail for the whole job. In too many cases the machinist knew much better than the "planner" how the work should be handled. With the newer semi-automatic machine tools, the sequence of operations is largely determined by the machine itself. It frequently happens that the man on the job sees ways of improving the method prescribed by the instructions. Shops that prevent this practical knowledge from being used are missing a good bet. To avoid this some shops show the foreman and the men who are to use special fixtures, the design of these fixtures before they are made, and get their okay on the preliminary sketches. Then it is up to the foremen and the men to make them perform.

John R. Godfrey

The Army Again

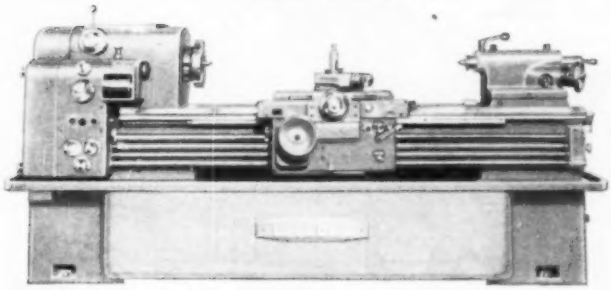
WE RECENTLY HEARD another variation on a well-known Army motto. This one is credited to the Medical Corps and refers to standard practice in treating patients: "If you can see it, put iodine on it; if you can't, give salts."

you don't need

attachments

to do most toolroom jobs

on the . . .



LeBLOND RT TOOLROOM LATHE

Standard features of LeBlond's RT replace most toolroom attachments, eliminate a bushel of change gears.

And you save hours of set-up time!

Just flick levers and turn dials to get spindle speeds as low as 6, as high as 1500 r.p.m. Make simple, quick adjustments for course threads down to 4" lead—American, diametral, module and metric pitch threads. RT also gives you exclusive, time-saving 4-directional rapid traverse to make *every* job easier.

The most versatile taper equipment in the business may be specified (at extra cost) with your new RT—to give you steep tapers up to 50° included, shallow tapers up to 48" long.

LeBlond also builds the RT in a 16" Heavy Duty Engine model —with 16 single-lever controlled speeds from 30 to 1537 r.p.m. 4-directional rapid traverse. Reverse to leadscrew at apron. Automatic chasing stop.

Sixty-three years of machine tool leadership stand behind LeBlond's complete line of 76 lathe models to give you day-in, day-out dependability. Your nearby LeBlond Distributor will tell you about the RT and other late models. Call him or write—

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

Sales offices in New York, Chicago, Detroit

RT

built-in features

4-directional rapid traverse

Combination belt and gear drive

Automatic chasing stop

Reverse to leadscrew at apron

Single-lever positive-jaw feed control

Automatic lubrication through headstock, feed-box, apron

toolroom lathe

Variable speeds—6 to 1500 r.p.m.

90 feeds—.0007" to 2.064"

90 threads—¼ to 120, American, module, diametral, metric

Start-stop-reverse spindle control at apron

7½ horsepower motor

engine lathe

16 speeds—30 to 1537 r.p.m.

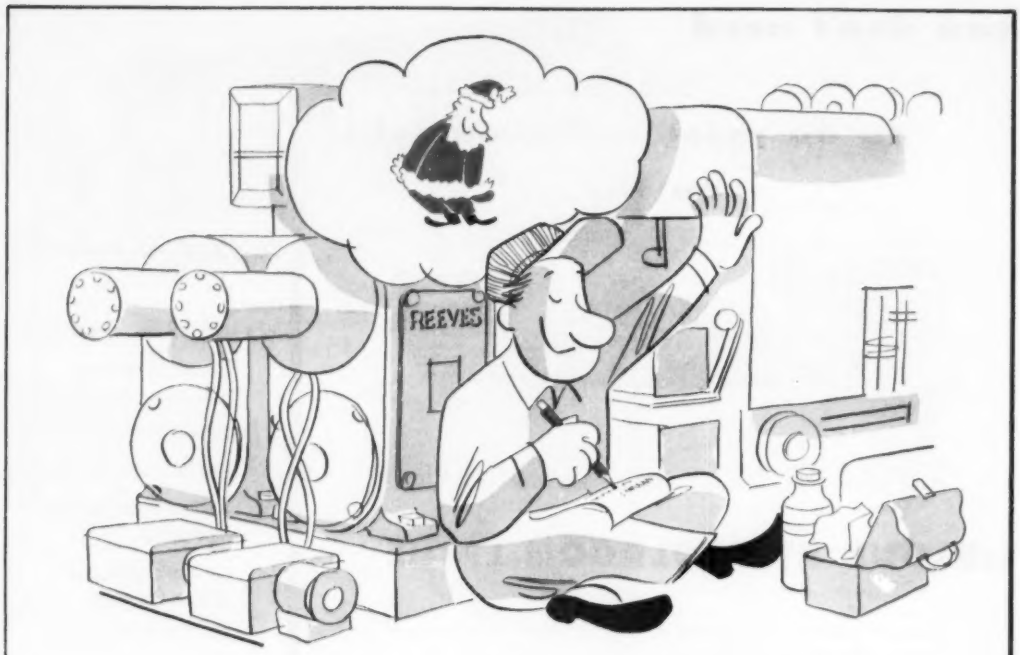
60 feeds—.0013" to .230"

60 threads—2 to 120

15 horsepower motor

LeBLOND RT Toolroom

World's largest builder of a complete line of lathes

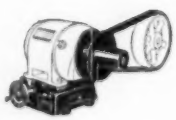


"All I want is a transfer to this job here, with the Reeves Hydraulic Automatic Control!"

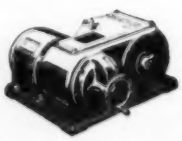
THE 3 BASIC REEVES UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.

VARI-SPEED MOTOR PULLEY provides an instantly variable speed drive within 4:1 ratio for any constant speed motor. Sizes to 10 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in a single unit. Speed variations 2:1 to 6:1, inclusive. Sizes up to 20 hp. (Also available in fractional hp sizes with speed variations to 10:1.)



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SPOT NEWS of Metalworking

- **Butt-welded titanium rings formed from bar stock** are being machined with carbide tools at speeds in excess of 300 fpm and at feeds of 0.012 ipr with excellent surface finish, at plant of American Welding & Mfg. Co., Warren, Ohio.

- **Continuous strip mill to roll magnesium sheet** will be built by Dow Chemical Co. near St. Louis at cost of $25 million. Plant will be ready in 12 to 18 months and will have capacity of 3 million lb a month.

Aluminum is to be used far more extensively in ship construction than heretofore. A few of the smaller naval ships are being built with aluminum hulls. Two or three all-aluminum tankers are now in service experimentally.

- **Powdered iron is being employed** by one midwest company to make hydraulic pumps for operating car tops and windows. Pump body, gears and cover plates do not require any machine finishing. Only the face of the mating surfaces has to be ground for oil tightness.

- **Reserve machine tools owned by Air Force and Army** are to be brought up to standard used in Navy, according to new Munitions Board policy. Navy all along has removed and replaced worn and broken parts, and in many cases stored machines in dehumidified warehouses.

- **General Electric expects to have a dozen gas turbine plants** (10,000 to 15,000 kw capacity each) in operation in stationary plants in 1952, if defense work does not interfere, GE's president Charles E. Wilson states.

- **Critical materials in new models of aircraft jet engines** will be much less than in current models. New General Electric models use one-third less; eventually reduction will amount to two-thirds. Another engine builder has produced experimentally a unit which does not take any of two highly prized metals now considered essential.

- **Air bearings, lubricated by film of air 0.001 in. thick,** have been developed for certain components of guided missiles by North American Aviation, Inc. Guided missile parts using these bearings are friction free, bearings sliding on molecules of air in bearing race. Air is forced into race through capillaries 0.003 in. in diameter. Technicians in North American's shops use powerful lenses in working on bearing races.

Republic Steel will add 672,000 tons to its steel-making capacity in Cleveland at cost of $75 million to be written off taxwise under government certificate of necessity. First steel will be poured early in 1952. Empire Steel, Mansfield, Ohio, is to increase its capacity 20% and become essentially a producer of hot-rolled strip.

- **Export licenses for production equipment** to European countries are being granted after having been held up for many weeks on some items. Total hold-up of all sorts of goods because of license delays amounted to 27,000 items at one time.

- **No important labor legislation is expected to come out of the new Congress.** Taft-Hartley law will not be touched. Even the 28 amendments to Taft-Hartley passed last year by Senate are dead.

- **Atomic-powered submarine, first one to cost $40 million,** will extend greatly operational range of submarines while submerged and will run submerged at speeds greater than on surface, K. A. Kesselring, assistant head of engineering division Knolls Atomic Power Laboratory, Schenectady, N. Y., told American Society of Mechanical Engineers. Atomic power might reduce weight of submarine's power plant. Even heavy shielding around atomic reactor, to protect crew, might weigh less than heavy fuel tanks and batteries in conventional submarines.

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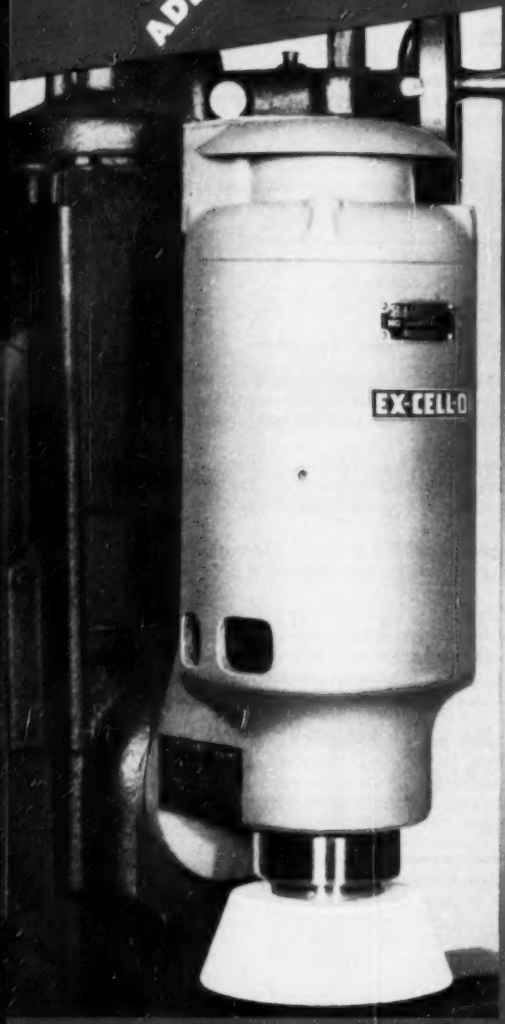

Ex-Cell-O 1 horsepower, 3600 rpm inbuilt motor spindle for surface grinder. Spindle swivels vertically, is used for sharpening cutters and broaches.

Standard horizontal Ex-Cell-O Precision Spindle with 1 horsepower, 3600 rpm inbuilt motor for surface grinders. Standard Ex-Cell-O belt-driven spindles also are available for this type of grinder.

This Ex-Cell-O High Speed Attachment drives small wheels at 18,000 rpm. It is driven by the standard motorized spindle and is supported by the standard spindle or spindle bracket.

You can add to the flexibility of your surface grinders, and perhaps save the cost of another machine, with Ex-Cell-O spindle equipment. For instance the large photo at left shows an inbuilt motor spindle that swivels vertically. It makes a standard surface grinder suitable for sharpening cutters and broaches. A mounting member extends through bore in column that ordinarily houses the standard horizontal spindle.

The Ex-Cell-O High Speed Attachment also adds to the flexibility of surface grinders. This attachment mounts on the standard horizontal spindle or spindle bracket. The standard surface grinding wheel is replaced by a pulley that, through a flat belt, drives the high speed spindle at 18,000 rpm. Thus, small wheels can be driven at an efficient speed for grinding small shoulders, slots and other hard-to-reach places.

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Washington

"Defense spending won't go over $18 billion this year (fiscal 1951)—no matter what happens." That will be true whether the second supplemental request finally approved by Congress is $5 billion or $15 billion.

The pattern is already set. Total military expenditures in October just barely topped $1.4 billion. Monthly rate by next June will just about hit $2 billion, or an annual rate of $24 billion.

Of that $18 billion, $1 billion will be for foreign arms aid. The rest goes for supporting our troops in Korea and building U. S. forces generally.

Contracts are still going out to industry at a rate of about $2.8 billion a month. That's for some soft as well as hard goods.

That rate will be maintained into mid-winter. After that it will start tapering off, until it settles down to about a $1.8-billion rate sometime about next summer.

That's the long-term military buying rate now forecast. It amounts to $21.6 billion in Defense Department purchases each year from U. S. industry.

It's a marked letdown from the $30-to-$35-billion figure Pentagon people were aiming at earlier. But it's the most the Administration figures it can reasonably count on maintaining in the long run. And, it will insure a modern, if somewhat smaller, force than earlier planning called for.

Figuring is that future Congresses won't balk at a $33-billion annual military budget, whereas they might refuse to appropriate $50 billion or more a year for the next ten years.

• • •

The 3-to-3.5-million man force is out too, for two reasons. First, a $33-billion budget wouldn't support that many. Second, there won't be enough 19-year-olds available in the next few years, unless you put them in for 36 months, which would be politically unacceptable.

A top limit of 24 months on compulsory military service is likely. It wouldn't support any more than a 2.8-million man force. You get the impression over in the Pentagon that the final figure for the size of U. S. forces won't be over 2.5-million.

• • •

Universal military service—not universal military training—is what the Administration wants now.

It would replace the draft—take each "class" of 19-year-olds, train them in the Army, Navy, or Air Force and put them in for a period of active duty. At least six months overseas service would be the objective for each trainee.

Special emphasis would be placed on training specialists, in electronics, aviation and automotive maintenance, engineering, communications, machining, etc.

Idea of UMT was merely six months' indoctrination under civilian (not military) instruction.

• • •

Washington is still betting against a war with Red China—betting that Mao's armies are in Korea to protect the vital Yalu River power plants, without which Manchurian industry couldn't produce.

Anyway when the talk is about a big war, defense planners still figure that it will break out in Europe first. Assumption is too that it won't start any time soon. All of the Administration's mobilization planning is on this basis.

• • •

NPA's cut-back order on civilian use of aluminum sets the pattern for things to come for other metals.

Similar orders are due shortly on the non-military consumption of copper, nickel, and zinc. Principle of the 60 days' supply ceiling already placed on aluminum will be applied to other metals inventories.

The 35% saving in aluminum has been allocated to defense programs — for stockpiling now, the aviation industry later when aircraft production is up.

Part of the remaining 65% will be allocated later to essential civilian industries, such as electric.

• • •

There's even some talk that a complete materials control order may be in works for sometime next summer. Actually, chances are—with the slower mobilization now planned—such complete coverage may never be necessary.

Controls will get tougher however for some time to come. The bite that defense is taking out of the economy is still a long way from even a lower level-off point.

Besides Washington plans to make up cut-backs in military buying by speeding up expansion of basic industries. Object is expansion enough to make a continuing $33-billion defense budget as unnoticeable as the $14-billion budget was before Korea.

• • •

NPA has started hiring a policing staff to make sure industry is obeying its orders. The Defense Production Act provides fines and jail sentences for violators.

• • •

No steel strike. All signs point to a wage settlement with big steel before the Dec. 31 deadline. It will be around 15 cents.

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Detroit

The end of the 1950 automobile model year is at hand. Companies which have not yet shut down on their 1950 runs will be doing so within the next few weeks. Introductions of 1951's, already well in progress, will continue through December and early January.

New Fords: The big news on them is the Fordomatic transmission, an optional drive combining torque converter and planetary gear train. In "dirve" position, the normal starting-intermediate gear shifts to high ratio between 17 and 65 mph, depending on the amount of acceleration. Other changes: comparatively minor, except for one notable design revision —there are two spinners at the front.

New Lincolns: They show few changes from 1950's; rear fenders are longer and grilles are new. Engine horsepower is up from 152 to 154 through a number of refinements.

• • •

Changeovers are reducing current output to the lowest levels in some time. The 175,000-a-week rate of the past few months is down 15,000 and more today. It will slip well below 150,000 as Chrysler and GM divisions begin to shut down in early December.

Another contributory factor is steel and parts. Ford is trimming schedules due to steel shortages. Nash and Packard went down in November because of parts shortages accruing from a supplier plant strike in Detroit.

The industry is waiting with high interest to see what happens next at Chrysler. Lester L. Colbert, Dodge president, was installed in early November as president, succeeding K. T. Keller, now board chairman.

Colbert began to move quietly, installing a new president, C. E. Buchholzer, at Airtemp, and transferring the erstwhile Airtemp chief, W. C. Newberg, to Dodge.

Interest attaches to the entire picture by virtue of the retirement age stipulation and the age of top executives in the company. Keller himself became 65 on November 27. He has turned over all active administration duties, however, to Colbert. Much of the rest of the top Chrysler team is crowding 60, above or below—B. E. Hutchinson, Herman Weckler, A. Vanderzee, the Zeder-Breer-Skelton engineering trio, others. So 44-year-old Colbert will have plenty of top jobs for whom successors will need grooming before long.

• • •

At Ford a prominent veteran has gotten a big new assignment. William F. Pioch, known to machinery men everywhere, chief engineer of Willow Run during the war, has been put in charge of manufacturing engineering at the new Ford aircraft engine plant, Chicago.

• • •

Purchasing Departments are beginning to wonder whether the steep price rise of past months will sustain itself indefinitely. Many think that a leveling off has begun. That's indicated in recent forward buying figures. Buying for delivery six months or more ahead is diminishing; there is greater concentration in the two to three month term.

• • •

Inventories, meanwhile, keep increasing. Employment is leveling out. The combination of those two facts means that the general level of business is at least momentarily stabilizing itself in the Detroit plants.

One reason employment is stabilizing is simple. No more quality manpower. During October only 26,000 workers were available, as the state employment offices tallied them. Employment had reached to a postwar peak of 1,170,000 persons in the Detroit area.

LESTER L. COLBERT, new president of Chrysler Corp., succeeding K. T. Keller, now board chairman

W. C. NEWBERG leaves Airtemp presidency to become vice president and director of Dodge Div.

WILLIAM F. PIOCH, manager of manufacturing engineering at Ford Aircraft Engine Div.

LEROY SPENCER will succeed Col. J. G. Vincent as executive vice president of Packard

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Machine Tools

British Ministry of Supply has placed orders for $20 million of U. S. machine tools as initial part of a buying program in this country, which will total $120 million. Purpose is to tool for manufacture of jet engines and other defense items.

Having enough dollars to finance the deal temporarily, the British didn't wait to get final clearance in Washington for reimbursement under terms of Mutual Defense Assistance Pact. However, they expect U. S. to provide the funds to cover these purchases.

Eighteen months is the delivery time being promised on many of the machines. Deliveries may be speeded later on if NPA grants some form of priority to tools for European armament production.

• • •

Prospects are waning of France, Holland and other western European countries contracting for many U. S. machines for armament programs during 1951 fiscal year. Reasons: military officials in those countries find it hard to agree on what items to make; governments can't make up minds whether to sell, lease or give equipment to arms manufacturers.

Some $6 million allotted to these countries for U. S. tools toward end of last fiscal year has gone begging thus far. It may be used up early next year.

• • •

Long deliveries have not cut off entirely the placing of ECA-financed machine tool orders. One western German project is to take half a million dollars of U. S. machines, the orders to be given on a deliver-when-you-can basis.

• • •

With at least $200 millions of machine tool business to be awarded U. S. builders by our European allies for armament purposes during this year and next the U. S. armed services now are saying that they should handle the job instead of ECA. Presumably, Pentagon would try to bypass the dealer and do business directly with the builders.

ECA intends to point out that these transactions should be handled through regular trade channels, as they always have been. European dealers, for one thing, provide valuable engineering services in helping decide what tooling the arms plants need. What's more, dealers have exclusive selling contracts for U. S. machines to be exported to specified territories.

French Mission in this country has expressed a wish to do business directly with U. S. builders on ECA-financed transactions. ECA has not encouraged the French. ECA officials are aware of the valuable work done by French dealers in figuring out the U. S. machines required for certain armament jobs. The French request is being denied.

• • •

Aircraft engine programs in this country are providing fresh machine tool orders of sizable proportions. One jet-engine maker is spending some $30 million for 1600 machines, of which all but 300 or less will be new. This is part of expansion of jet output which will continue during 1951.

Latest information about Ford's tooling plans for the former Dodge-Chicago plant put its machine tool needs at $65 million. But no actual business is stirring there yet.

• • •

New machine tool orders in October surpassed the September total, acording to preliminary figures of National Machine Tool Builders' Association. September was 283 on the NMTBA index. Peak was 307.3 in August.

Foreign orders in October doubled those the previous month. Shipments hardly kept pace with September. Inability to get steel and other materials, shortages of controls and other components, and growing tightness in labor market are responsible for lagging machine tool production.

• • •

Task force of NPA Machine Tool Advisory Committee has presented to General Harrison, NPA administrator, the case on behalf of priorities for materials and components for the machine tool industry if defense contractors are to get the machines they need when they must have them. (see Editorial, p. 91).

• • •

Backlog of machine tool orders swelled further during October. At present, deliveries are more extended than at any time during World War II.

• • •

Herbert L. Tigges, executive vice president of Baker Brothers, Inc., Toledo, has been appointed consultant on machine tools to NPA's Machinery Division. He will be chief of the Machine Tool Section, spending three days a week in Washington. His office will be in Temporary T Building on Constitution Avenue.

• • •

Machinery Dealers' National Association, 20 North Wacker Drive, Chicago, still needs help of used machinery dealers in compiling inventory of used tools in hands of dealers. Survey is being made at urgent request of NPA.

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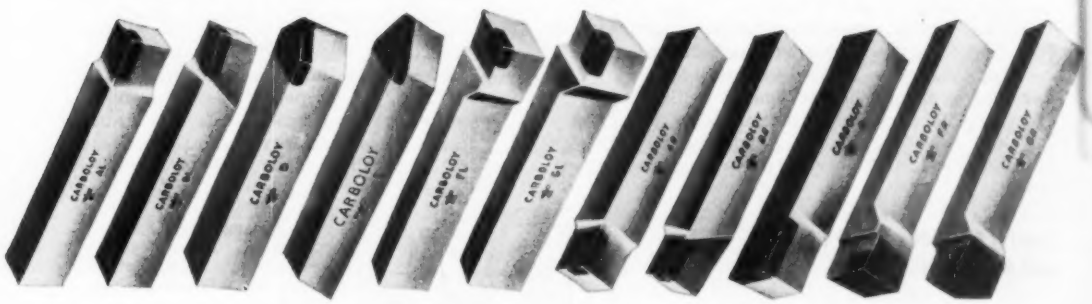

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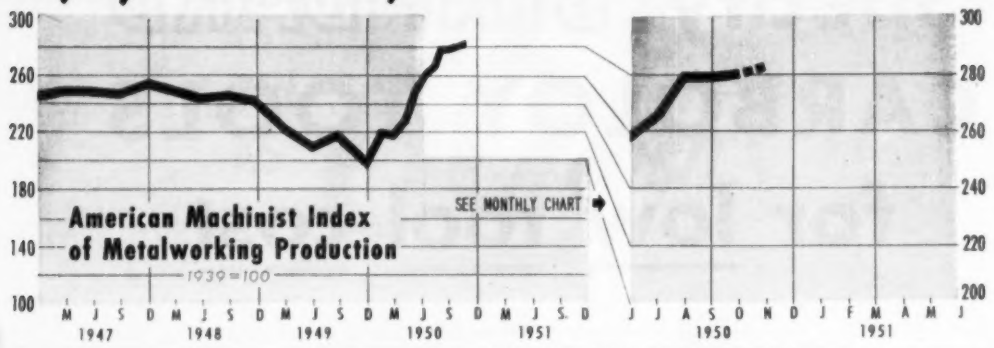


Metalworking Continues Record Climb

Metalworking operations continue to climb slowly but steadily toward new heights (excluding World War II). Index of Metalworking Production of AMERICAN MACHINIST is estimated at 283 for November, up two points from October.

That is a 28-point rise since last June. Even more spectacular, it represents a jump of 79 points from a year ago.

• • •

December should see no decline from the current heights. Only point of controversy is whether cutbacks ordered in use of aluminum and other materials will temporarily check a further rise early next year until defense output can take up the slack. Good guess is that there will be no drop in manhours worked.

• • •

Plans for capital expenditures on new plant and equipment in the metalworking industries during 1951 are up sharply over 1950 levels.

Spending by the automobile industry is likely to be 17% higher next year than this year. Machinery, excluding electrical, will increase 19%. Electrical machinery people will spend 33% more, and transportation equipment builders (not counting auto makers) will almost double their investments compared with this year.

• • •

Metalworking leads all of industry in expansion of employment. Aircraft is in the forefront. And labor is very hard to get. One aircraft company now employing 18,000 workers hopes to boost its payroll to 28,000 by next summer. It is scouring large areas and using all sorts of promotion devices, not to mention high wages, to lure new employees.

Currently 51 areas in U.S. are in a scarce labor supply situation. A year ago there were only six. Unemployment in October dropped to 1.9 million, from 2.3 million in September. The jobless group no longer is an important source of additional workers for defense industries.

• • •

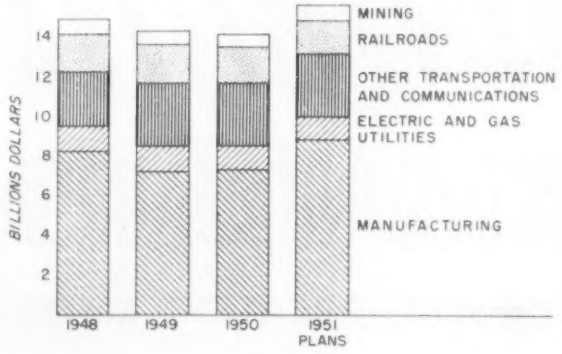
Recent NPA order slashing consumption of aluminum 35% for civilian goods after Jan. 1 promises to bring some layoffs in consumer durable goods industries (autos, appliances) which may relieve labor shortages elsewhere.

Capital Expenditures for Plant and Equipment

(Billions of dollars)

	1948	1949	1950	1951 plans
Manufacturing	$8.160	$7.200	$7.330	$8.770
Railroads	1.345	1.310	1.160	1.240
Electric & gas utilities	2.680	3.160	3.200	3.200
Other transportation & communications	1.900	1.880	1.770	1.600
Mining	.765	.750	.660	.775
Grand Total	$14.850	$14.300	$14.120	$15.585

(Source: McGraw-Hill Dept. of Economics)



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	NOV. '50	OCT. '50(p)	SEPT. '50(r)	OCT. '49
	283*	281	279	216
Machinery		254	249	199
Electrical Manufacturing		325	323	241
Automobiles, Trucks		259	258	203
Transportation Equipment		277	288	231
Other Metalworking		307	307	229

AMERICAN MACHINIST'S INDEX OF METALWORKING PRODUCTION is based on manhours worked in the five components above.

*Estimated (p) Preliminary (r) Revised

Some aluminum users feel that aluminum cutback would have been inevitable because coming steel curtailments in themselves will bring a decline in aluminum use.

Many aluminum fabricators, especially appliance makers, claim they cannot get, much less use, substitute materials. Some of them now are scurrying to land defense orders. Many complaints are made that defense work is not in sufficient volume to take up the slack from the enforced cut in civilian production.

Aluminum order is even more serious than it appears because base period for cut is first six months of 1950. Aluminum use recently has been heavier than it was earlier in year.

• • •

Steel users are worse off than ever. Bars and sheet, for example, are harder to get every day. Even black market is drying up fast, with prices 50% above mill prices.

Main steel suppliers say that December allocations are likely to be cancelled completely or cut way back to permit mills to catch up with order books and start 1951 in better shape. Some mills, on other hand, have told important customers that they will accept DO orders and not deduct them from regular allocations.

Subcontractors in increasing numbers are relying upon prime contractors for their steel. Cold-rolled strip still is the most critical item of all.

• • •

There will be no strike in steel. Outcome of U. S. Steel negotiations probably will be 15¢ increase in hourly rates and a hike in steel prices. The union, subdued by results of election and proximity of shooting war, is known to be in no mood to strike. Steel management wants no strike at this time of super-demand for steel.

• • •

Pinch in alloys is being felt. Large users are busy eliminating columbium and nickel from civilian goods. Shifting around in materials, substituting one for another, is at highest point since worst period in World War II.

• • •

Gray iron and malleable foundries are loaded with work. Many new orders are being turned down. All customers are crying for quick deliveries. Defense orders are beginning to show up in some midwest and western shops.

Malleable people report heaviest demand still is from automotive industry, with railroad car building program starting to be felt.

• • •

Incoming business remains at high level for railroad freight car manufacturers. Example: one prominent builder has orders for more than 30,000 cars, as against 700 at start of year.

Recent steel allotments for freight cars will enable builders to get into full production swing by February or March. Second and third shifts will be added. Major changes in tooling or in assembly line practices are not contemplated.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1923-1925 = 100)*	219.7	220.9	166.5
Steel ingot operations (% of capacity)	102.7	103.0	57.4
Electric power output (million kilowatt hours)	6,574	6,551	5,435
Production of automobiles and trucks	161,113	177,096	114,856
Engineering construction awards (Eng. News-Record—millions)	$214.9	$101.9	$217.8

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators, domestic sales (thousands of units)	512	496	309
Vacuum cleaners sales (thousands of units)	328	341	250
Washers sales (thousands of units)	424	381	357
Household electric ranges sales (thousands of units)	156	132	91
Television receivers production (thousands of units)	817	702	225
Radio receivers AM and AM-FM production (thousands of units)	832	754	532
Gear sales index (1935-1939 = 100)	654.5	617.4	224.9
Foundry equipment new orders index (shipments 1937-1939 = 100)	483.8	693.6	166.6

* Seasonally adjusted.

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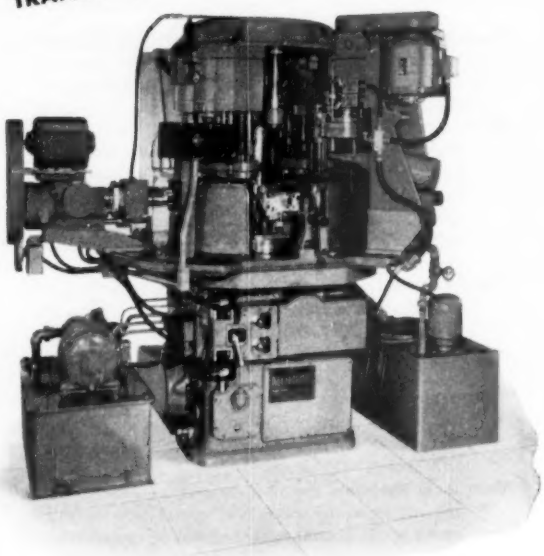
MORRIS *Mor-Speed* PRODUCTION MACHINE



A COMBINATION of Morris standard units . . . center column, base, indexing mechanism, hydraulic units . . . with a made-to-order vertical head, and auxiliary side heads, make up this high production machine. Use of the standard units, around which the high production unit is built, means that initial cost is much lower. In addition, the machine is more readily converted; design changes in the part *do not* mean the whole machine has to be scrapped.

Operating at 80% efficiency, the machine finished an automatic transmission control valve upper body with each index of the table. Part fixtures, hand-clamped, accommodate work pieces in two positions for the two cycle operation. A Morris 8-station center-column type unit, the machine is equipped with a 19-spindle vertical head, two hycycle motors for drilling operations, a six-spindle horizontal tapping head and a five spindle vertical tapping head.

If your work involves drilling, reaming, tapping or similar multiple operations on a production basis, investigate Morris Mor-Speed Production Machines. *Morris Engineers will gladly prove that high precision production can be yours . . . with worth-while savings in time, labor and space.*

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933 HARRIET STREET CINCINNATI 3, OHIO

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Top Priority for Machine Tools

Defense contractors are worried. They must get badly-needed machine tools on time. Without these tools, they will be stymied.

The machine-tool industry, meanwhile, is in a serious dilemma. It has been deluged with orders. And another flood is on the way. New defense programs, involving thousands of new machines, soon will break.

Machine-tool builders are struggling to expand their output. They are adding men (and, in some cases, women). They are lengthening their work-week. Second shifts are becoming common, and sometimes third shifts.

But more manpower won't do much good unless more materials and component parts are available.

TO GET the required materials and parts, the machine-tool industry needs more than pious wishes out of Washington. It needs help in getting steel, copper, castings, bearings, motors, controls.

It cannot get what it must have, however, if it is to be at the mercy of its suppliers, without possessing any special standing whatsoever.

How can it make a dent on the consciousness of steel people when it uses in its better years less than two-tenths of one percent of total steel tonnage?

Yet, at the start of a vital armament production program, who is brash enough to say that steel for freight cars is more important than steel for machine tools?

The machine-tool industry has been through relatively poor times. Its production the past few years has been small. It has a long way to go to get up to a basis which will meet the nation's requirements in a period of international tension such as we are in.

IT IS to the nation's welfare for the machine-tool industry to enlarge its output as quickly as possible. For our military strength can be no greater than our industrial strength.

Every new machine tool put to work in a metalworking shop adds to our industrial strength. It turns out more goods and saves manpower when manpower is in short supply.

This is no time, then, for fooling around. Speedy action is needed instead. NPA should grant without delay top priority to the machine-tool industry for materials and component parts.

That is the place for Washington to start if it really wants the defense production schedule to be carried out on time.

WHAT'S MORE, such action will be the best kind of insurance in case World War III should break out and our first concern would be to tool up every available shop for war production.

Burnham Finney

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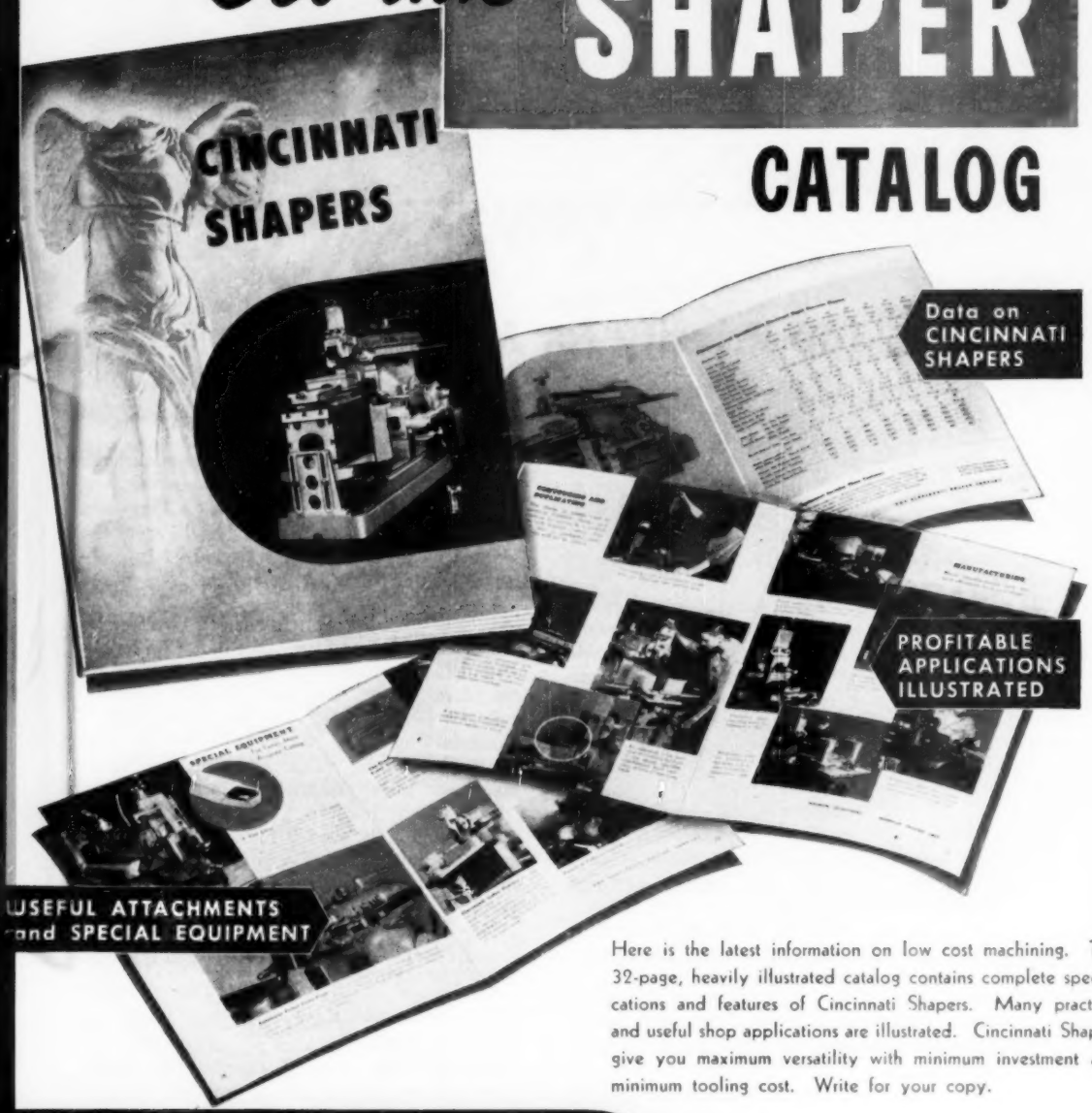

Here is the latest information on low cost machining. This 32-page, heavily illustrated catalog contains complete specifications and features of Cincinnati Shapers. Many practical and useful shop applications are illustrated. Cincinnati Shapers give you maximum versatility with minimum investment and minimum tooling cost. Write for your copy.

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Department 200 is a general machining section containing a sufficient variety of equipment so 90% of the parts it processes can be completed within the department. When organized to give complete service to operators, this department increased output 60% over comparable old-type departments. Most machines are less than five years old and working conditions are excellent. The department has good lighting and is air-conditioned

In Department 200, Machines Run 88% of the Day

Running time per day on production has jumped from 55 to 88% because of a system in which everything is supplied to the operator. Yet, machines may be set up as many as two or three times per day

BY OSCAR V. PAYNE, Works Manager
Crompton & Knowles Loom Works, Worcester, Mass.

HOW CAN we keep our machines running a greater percentage of the working day? This has always been a problem for us—and for most plants that operate under conditions similar to those that characterize our production.

Our product is textile machinery. Most units are large and bulky, contain thousands of parts, and require many hours of assembly time. Orders are for small quantities and virtually no two orders call for machines that are exactly alike. It is not practical to maintain a complete stock of all parts, yet assembly must not be held up for lack of parts, as we have no room to store partially assembled machines. Much of our work in process, therefore, is determined by orders on hand, and machine schedules must be closely related to assembly schedules.

Operating on this basis avoids huge inventories but involves one serious danger: Machine downtime can become so high as to limit production. In our case, we knew that it was possible to move our product through assembly at a faster rate and thereby step up output. Yet to do so would require more machines and additional floor space neither of which were available. Furthermore, our real trouble was that machines were not running enough hours per day. Production records showed that some of our machines were working only 55% of the time on actual production. Knowing this, we decided to make a thorough study of our production procedures. The result was the creation of Department 200.

Department 200 is organized around four basic ideas: (1) Everything is supplied to the operator. There is no need for his leaving the machine, except for personal reasons. (2) The department contains a sufficient variety of machines so 90% of the work entering the department can be completely machined before it leaves. (3) Adequate space is provided for mechanized handling and for keeping a job ahead of each machine. (4) Operators are paid an incentive wage and working conditions are the best we can provide.

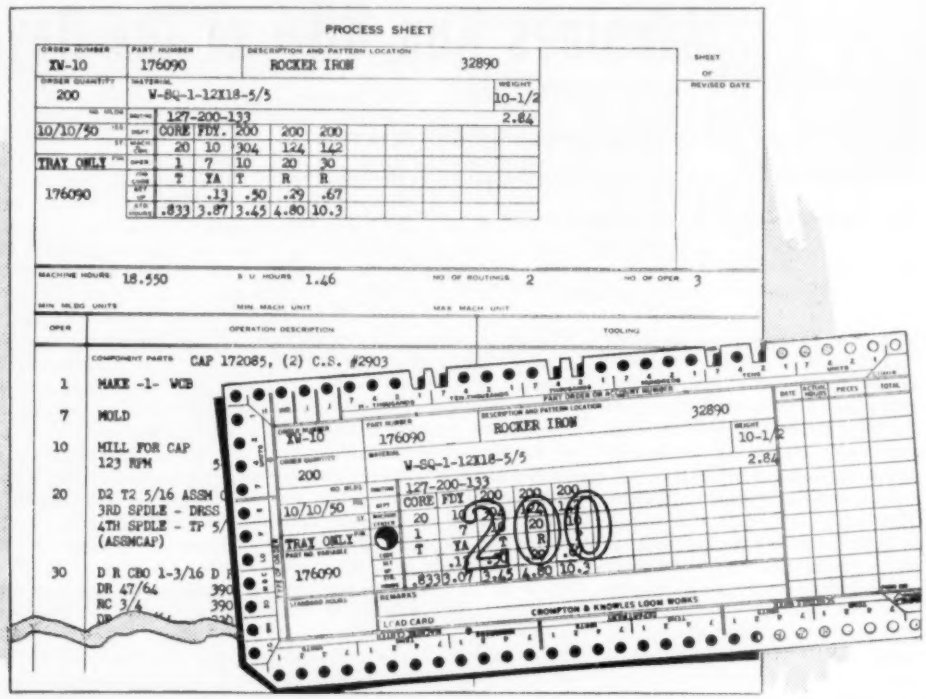
In setting up a department of this kind, one of the most important questions is this: How large should the department be? In our case, we wanted a production unit that could be supervised adequately by one general foreman. To be fully effective, the department must be kept under close control and there is a limit to the physical size of an

area that can be covered properly by the one man. In Department 200, we feel that we are at the maximum size that should be attempted in a setup of this kind. In fact, the next time we organize a department along these lines we probably will set up on a smaller scale.

In Department 200, we have 86 machines and 132 operators working on a multiple-shift basis under one general foreman. Working with him, also on multiple shifts, are 70 line and staff people. There are 10 sub-foremen, 2 methods engineers, 17 production, material, and administrative clerks, 7 inspectors, 14 truckers, 17 runners and tool crib attendants, and 3 setup men. This organization produces as many as 2400 orders per month, with 9600 operations required and each machine set up several times a day on the average. Yet, the total time that machines do not run on production, including time for setup, has been held to an average of 12% over the past 2 1/2 years.

We feel, therefore, that we have accomplished our purpose in Department 200 and, in planning smaller units for the future, we do not expect higher efficiency. Our objective is to make the foreman's job easier—to give him a department that he can supervise closely, yet one in which he has ample time to evaluate over-all operation and performance. In this way, he is in a position to know what changes in the setup should be made to maintain initial high performance in the face of changes in the nature of his production load. The question of how much load to give one foreman may well be considered the major factor in the success of an otherwise well-planned organization. However, once the load is determined, careful attention to the physical layout and operating details of the department is necessary.

General Planning — A careful study of production was made to determine what jobs should be routed to Department 200. The objective was to pick those jobs on which activity was the highest and which could be completed on standard equipment. Also to determine the sequence of operations that occurred most frequently so machines could be arranged accordingly. Obviously, in a general machining department, the layout will not be perfect for all items; but back-tracking and rehandling can be considerably reduced by planning the layout to favor those items that make up the greatest proportion of the total work of the department. It was necessary to make a detailed study of job routing and operation times to determine machine requirements,



Process sheet is key record and contains complete description of processing, tooling, and payment. Job cards are produced from the Process Sheet and are similar to Master Control Card shown. Master card controls flow of work through department, with progress posted to Master from job cards, which are made up for time payment, material control, inspection, and so on. All cards are preprinted and are interchangeable among operations. Punch coding permits ready sorting by part number, order number, machine center, and other classifications

machine loadings, and departmental layout. Data then had to be worked over to obtain a balanced department at estimated new levels of efficiency. A new process sheet was prepared to overcome objections to the one in use.

Production—Shop orders go to the production office in Department 200 and are assigned to a floor production clerk. Each clerk maintains loadings on individual machines and has a rack in which orders ahead of each machine are filed in the order to be machined. Material is held in a storage area adjacent to Department 200. Also adjoining the department is a crib in which perishable tools and the more active jigs and fixtures are held. When a job is nearing the front of the work-sequence file, the production clerk obtains the drawing, orders the material moved in from storage to the machine, has a runner get the tools from the crib, and sees to it that all of these are delivered to the proper machine before the job currently in work runs out.

Operators—Although each operator makes his own setup, the setup is checked by a setup man who helps out if needed. As soon as one job is completed, the operator tears down the setup and places the tools where they will be picked up and returned to the crib by a runner. The next job is waiting and can be put in immediately. Payment is made on an earned hour basis with standard hour allowances set for a liberal bonus.

Inspection — Inspectors float through the area. When a job is set up, the operator signals an inspector to check the first piece. The job continues while the check is made. The inspector returns for other checks at unscheduled intervals during the day.

Tool Crib—Upon their return to the crib, all tools are examined by a competent attendant who judges their need of attention. Tools that need sharpening are sent to a central grinding department. After grinding, each is dipped in a plastic solution that forms a thin film over the cutting edges and protects them during their period in storage. This film can be removed easily when the tool is needed. If jigs or fixtures are damaged or otherwise unsatisfactory, they are sent to the tool room for repair or reconditioning. The objective is to keep everything in A-1 shape, ready for immediate use when needed. An inter-communications system connects the crib with the tool room and foreman's office.

Production control for the department is handled through Central Control Section and four floor production centers strategically located throughout department near machines that they serve. Each center has work assignment board, above, with separate tier for each machine. Cards are in order of machining sequence and are arranged relative to time scale at top of board to indicate approximate job run times and total ready-to-run work load

Trucking and Stores—Incoming material goes into temporary storage in an area outside the manufacturing section. Material is spotted in numbered location and can be located easily when wanted. Power lift-trucks speed the movement of material into this area and from here into the manufacturing section. Movement from machine to machine within Department 200 for the most part is performed with hand-guided powered lift-truck. At each machine there is space for one job in addition to the one in work.

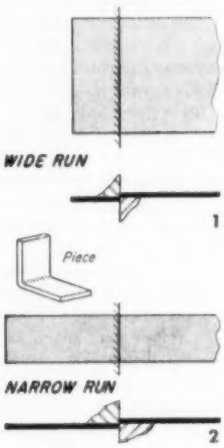
Working Conditions—In recognition of the importance of pleasant conditions of work, Department 200 is equipped with the latest in fluorescent lighting and air-conditioning apparatus. For the comfort of the operators, we follow a practice that is not recommended for those who seek economy in operating an air-conditioning unit and permit the temperature to rise gradually, so operators are not subject to an appreciable change in temperature upon leaving the department. The same is true of the incoming shift. We have been doing this for more than a year and find that our operators are all in favor of the practice.

Introduction of this system has increased our total indirect labor cost over what was required for the same number of machines under our old system. However, the increase in production more than offsets increased overhead and results in an appreciably lower unit cost per piece. When it is further considered that the introduction of this system eliminated the need for additional investment in machine tools and building space, it is easy to see why we consider it well worth-while to spend enough on indirect labor to keep our machines running a maximum number of hours per day.

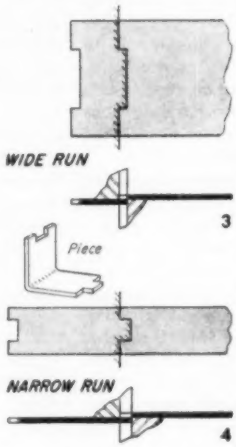
CHOOSE FROM 24 CUTOFF DIES

They cost less, and produce more, than any other type of press tool. Sketched are scrap-strip designs to help you in selecting the correct arrangement for your problem

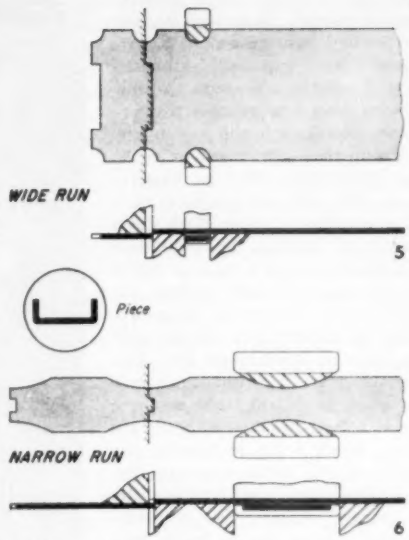
BY J. R. PAQUIN, TOOL ENGINEER
TORRINGTON MANUFACTURING COMPANY



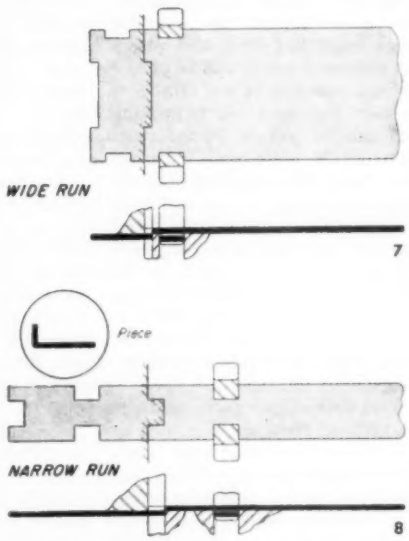
Shear Die .. Simple rectangular parts are sheared to width or length in dies of this type. To prevent excessive handling of material strips, parts are run the wide way. Where bends must be subsequently applied, strips are run the narrow way so bends will be across grain



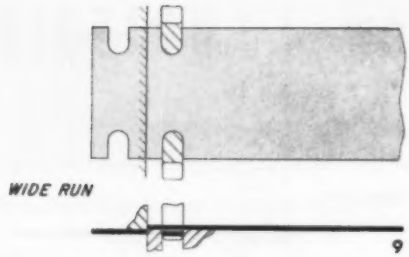
No-Scrap Shear Die .. Where part contour is adapted for production in a die of this type, the best possible condition for scrap-strip design is present. Often, a slight design change in the part will render practical its production in a no-scrap die at considerable savings

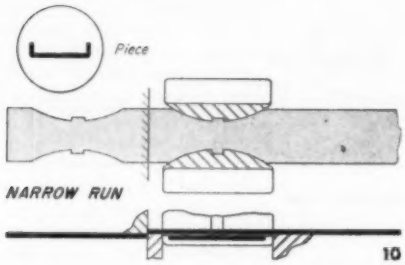


Notch-Type No-Scrap Die .. Irregular contours at the corners of no-scrap blanks are produced by notching punches at the station immediately preceding the cutoff station. Holes may be pierced either at the notching station, or the preceding station, as may be required

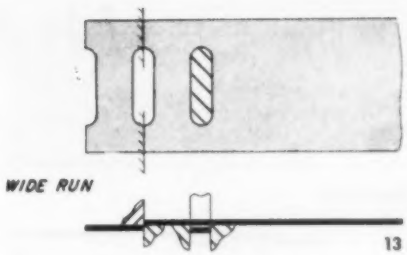


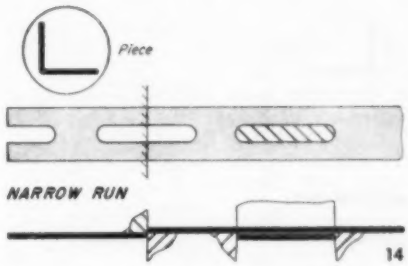
Notch Type No-Scrap Shear Die .. When notches are at the center of the part edges, notching punches provided with heels are located accordingly. This further increases the variety of blank contours of the no-scrap type which can be produced in cutoff dies



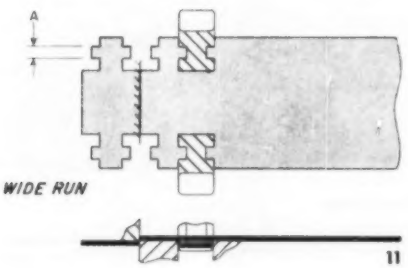


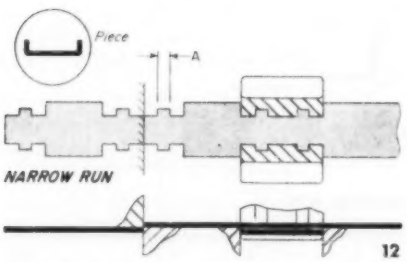
Notch and Shear Die .. Shear dies may be given a notching station prior to the shearing position, thus increasing their versatility. The shearing punch is usually backed up against a block which serves as a stop, and is screwed and doweled to the die holder



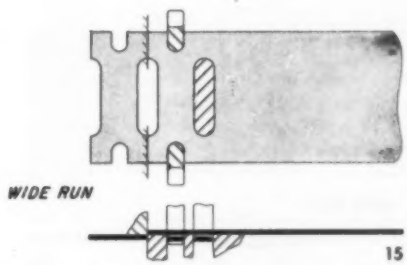


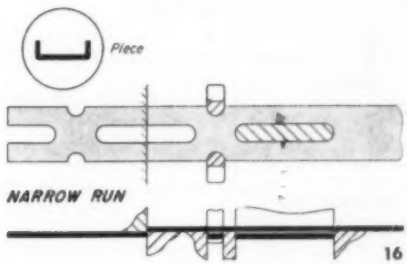
Pierce and Shear Die .. An irregular side or end contour may be applied to the blank by punching at the first station, and cutting off at the final station. Accuracy from cutoff dies is not great except at localized points by partial blanking, but generally is within commercial tolerances



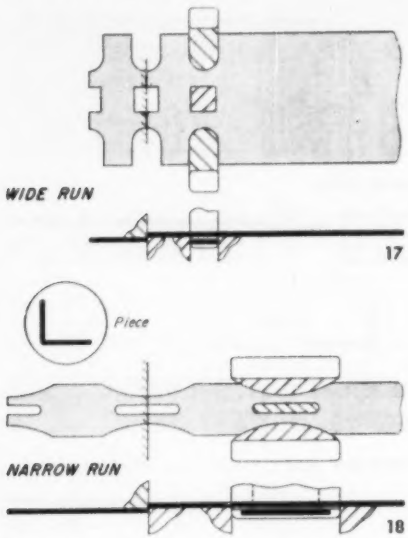


Notch and Shear Die .. Notching punches may be elaborate when part shape requires it. Here the part is partially blanked at the ends, which is desirable if dimension *A* must be held with a high degree of accuracy. This accuracy is inherent in the notching punch

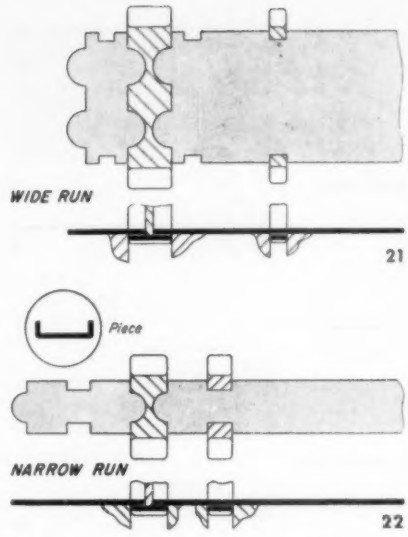




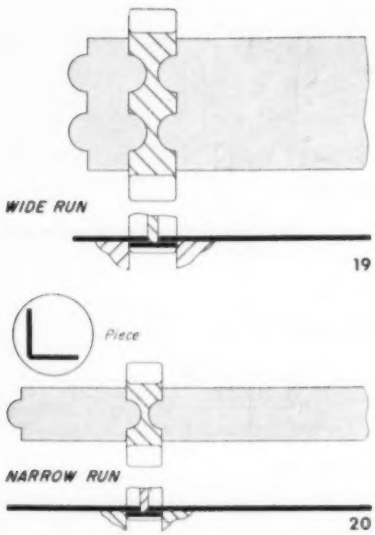
Pierce, Notch and Shear Die .. Blank ends may be notched, in addition to trimming the sides. Correct clearances must be applied between punch and die sections. All components must be made heavy enough to withstand repeated shocks



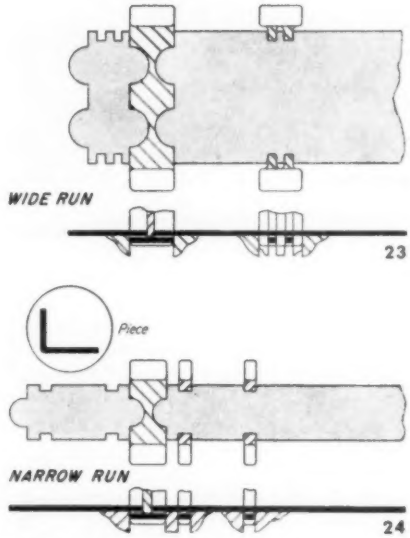
Notch, Pierce, and Shear Die .. When blank corners, as well as sides or ends, must be trimmed, this layout will give excellent results. Where enough room exists, the piercing punch is placed between the notching punches; otherwise it is moved back one station and a finger stop is added



Notch-Type Slug Die .. Irregular edges may be applied to parts produced in slug dies by the addition of notching punches at a station prior to the cutoff station. The strip layouts incorporate two notching punches to apply square notches to the edges of the strips



Slug Die .. A slug die completely trims the outline of both sides or ends of the blank and produces a partial blanking operation at those points. Burr is applied on the same side of the part at both edges. This is not the case with shear dies



Double Notch Slug Die .. A plurality of notches may be applied to the edges of the parts produced in slug dies. A single backup heel prevents deflection of the punch under cutting pressure. Piercing punches may be added at the notching station, if holes are required in the part

FRICTION ... what is it?

All around us, a vital part of everything we do, familiar to everyone, friction is still a major mystery to scientists and engineers the world over. What doors would the correct answer unlock?

Two schools of thought about friction are shown in the box. First, the so-called "classical laws," and then the revisions that have resulted from the more recent molecular attraction theories. Three out of four contradict each other. Neither group may be called irrefutable as "law". Both represent only a surface scratching in the field of frictional phenomenon. Current opinion of qualified authorities seems to be that the principal role is played by molecular forces. It may go even deeper—to atoms and their structure.

Frederic Palmer, in his paper "What About Friction?" prepared as a result of experimental work at the Franklin Institute Laboratories, Philadelphia, Pa., writes, **"What, then, about friction? The answer is that in spite of both classical studies and recent advances there is hardly a single phase of the subject which is not still in the controversial stage. Authorities are in general agreement as to the nature of heat, character of light, X-rays, radioactivity, and relativity—all topics of comparatively recent origin; but there is no such agreement with regard to friction."**

Rather than be discouraged because the classical laws are proved erroneous or largely inadequate, Palmer says of the student: "He should be thrilled by finding that the subject of friction, though old in years, is still young so far as an understanding of its fundamental phenomena is concerned. By carrying on research in this field of such great practical importance there lies an opportunity for him to make a scientific contribution to the advancement of knowledge."

New Horizons

Recent issues of *American Machinist* (Dec. 29, '49; Mar. 6, Apr. 3, '50) have carried articles on the current research into high-speed machining. At this stage activities are small and scattered, but results are astounding. Production increases up to 15 times have been achieved! It is a new concept in Metalworking—and there is scant doubt that this is certainly research of practical importance.

Research in frictional phenomenon is applicable to all fields; equally practical. Improvements in wear resistance, hydraulics, bearing design, aerodynamics, and many other fields could result. Metalworking would be affected advantageously in many ways by a set of positive laws for, and by greater knowledge of, friction.

Machinability research now in progress foretells a whole new world in Metalworking — with speeds and feeds far above what is presently thought to be standard. This is not just cut-and-try adventuring, but a study that goes deep into the molecular and atomic structure of the material to be machined. Friction plays a major part in the result. New coolants, lubricants, cutting - tool designs, and methods become necessary.

One theory of friction is, rather than a simple mechanical action between surfaces, that it is the action of intermolecular electrostatic forces. A lubricant then becomes, to some degree, an insulator. When the forces are restrained, the grip is gone. If this is true and developments appear to point that way, then discoveries about friction closely parallel some of the current theories of metal structure, metal cutting, and, ultimately, high-speed machining.

When the tool is properly ground and both speed and feed correct, large chips are produced at great speed with no heat in tool or work; all the heat in the chip. Rumors have been received of a similar set-up which produces no heat at all! Is the power all absorbed in neutralizing intermolecular forces? If so we may be on the road to a revolution in Metalworking — and in many other engineering fields.

CLASSICAL LAW

Frictional force is directly proportional to load.

•

Frictional force for a constant load is independent of the area of contact.

•

Frictional force is independent of the velocity of sliding.

•

Frictional force depends upon the nature of the materials in contact.

MODERN THEORY

Frictional force is independent of load.

•

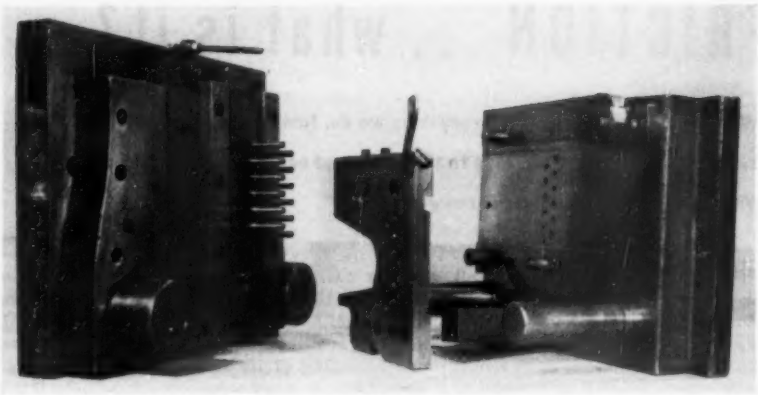
Frictional force is directly proportional to the area of actual contact.

•

Frictional force depends upon the velocity of sliding and, in the higher ranges, decreases with increasing velocity.

•

Frictional force depends upon the nature of the materials in contact.



A dozen different combinations of punch-and-die materials can be tested at the same time with this standard die developed for the Westinghouse lamination-die test program. Each punch is individually guided by a hardened steel bushing in the solid stripper plate shown in the center

Die Life Test Cuts Cost of Laminations

Controlled tests on lamination punches and dies establish superiority of carbide over cast non-ferrous alloys, and of carburized high-speed steel over high-carbon, high-chromium types

BY A. T. HAMILL, METALLURGICAL ENGINEER
MATERIALS ENGINEERING DEPT., WESTINGHOUSE ELECTRIC CO.

WESTINGHOUSE Electric Corp., embracing the entire field of electrical equipment manufacture, incurs a tremendous annual expense for lamination-die construction and maintenance, running into hundreds of thousands of dollars. Management, therefore, is continually seeking ways to improve lamination dies through the development of new materials, improved methods of construction and maintenance, and by installing better process controls.

An obvious means of reducing the cost of laminations is to prolong the useful life of dies by increasing their wear resistance. An increase of only 10% in the life of a die will produce tremendous savings through decreased allowances for machine down-time for sharpening, and for renewal of worn-out dies. The continued insistence of electrical designers upon lower burr heights on punchings to permit peak electrical performance makes this factor doubly important.

Experience has shown that die-life tests to evaluate new die materials and/or treatments, under shop production conditions, often are inconclusive because the influence of uncontrolled variables obscures the effect of the variable under consideration. Consequently, the materials engineering dept, functioning as an integral part of a company-wide lamination die committee, is conducting a standard die-life test. Punchings are produced in a specially constructed die under carefully controlled conditions, and the relative worth of promising tool materials is thus evaluated.

In this test die, the shoes hold 12 punch-and-die sets arranged in two rows of six each. Each set punches ¼-in. holes. Punches and dies are fitted into hardened steel holders. Massive guide pins are provided for over-all alignment, and each punch is individually guided by a hardened steel bushing mounted in a solid striper plate. Alignment and clearances are the best that can be attained by careful toolmaking.

The material for all the work reported here was electrical-grade steel strip, processed as follows: Hot-rolled sheets were butt welded, slit to the correct width, and

Bench-type dial gage micrometer is arranged with constant load on the movable anvil, and provides accurate, reproduceable indications of burr height on laminations and other punchings. This is the instrument used for measuring burr heights in the tests reported here

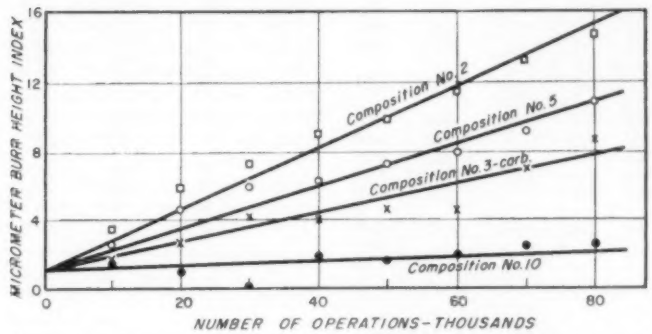
coiled. The strip was checked thoroughly for hardness, composition, and microstructure.

The strip was 0.018 in. thick and had a hardness of 149 Vickers-Brinell, except in the weld zone, where hardness averaged 181. Surface was bright pickled. Composition averaged 0.052% carbon and 1.38% silicon. All strip was from the same heat, and was processed at the same time to eliminate any variable effect upon die life related to the material being punched.

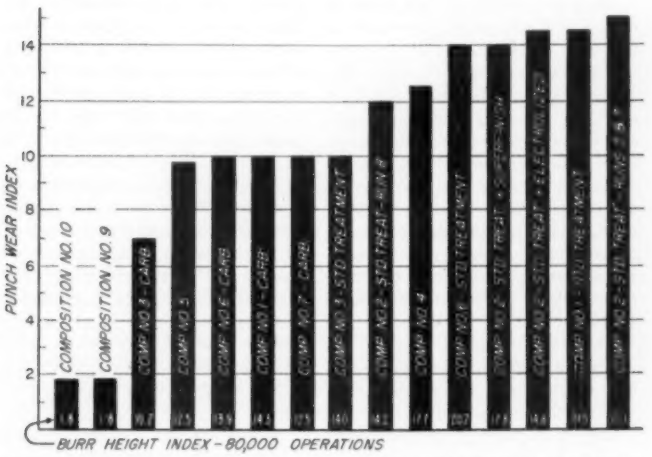
Preparation of Punches and Dies

All punches and dies were machined, heat-treated (where necessary), and ground to size. Dimensions and hardness were measured carefully after final grinding. A standard clearance of 0.00075 in. was maintained all around, giving a difference in diameter between punch and die of 0.0015 in. Diameters were measured to an accuracy of 0.00005 in.

High-speed steels were heat-treated in salt baths, using conventional hardening and tempering techniques, except in the case of the carburizing treatments which were performed by pack carburizing methods. Air-hardening steels were bright-hardened in an Ammogas (Westinghouse trademark) atmosphere. This atmosphere is produced by dissociation of anhydrous ammonia.



Data obtained from measurements were plotted for burr height versus number of operations for each combination of tool material and heat-treatment. Note wide variation between some materials. Lower curve is for cemented tungsten carbide, upper curve for a high-carbon, high-chromium tool steel

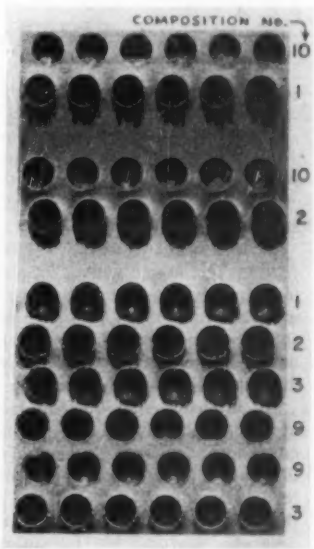


Average punch wear after 80,000 operations for 15 combinations of tool material and heat-treatment. Punch wear is measured as the minimum amount to be removed to sharpen it for reuse. Consistent superiority of carburized high speed steels over other punch steels is noticeable

Evaluation of Tool Wear

In any die-life test, accurate and consistent measurement of tool wear is of prime importance. Measurements of burr height of the punchings and of punch wear were used as the basis of comparison since, in actual production, it is the burr which governs when a die should be removed for sharpening. It has been found that there is a good correlation between burr height and punch wear, which agrees with the theory that the slug pushed through the die gets its burr from the punch.

Once it has been decided to measure burr height, there remains the problem of a reliable method of measurement. Many production shops still rely on the feel of the operators' or inspector's thumb; others use a simple micrometer to decide when a die must be removed for sharpening. Other possible methods are: 1) a simple microscope with a fixture for po-



Scrap strip from life test die shows superior wear resistance of carbides (No. 10) and cast non-ferrous alloys (No. 9) over conventional tool steels. Each horizontal row of holes was made by a different punch and die pair. Shadows cast by oblique lighting accentuate burr heights

NOMINAL COMPOSITION OF TOOL MATERIALS COMPARED

	COMP. NO. & GENERAL DESCRIPTION	% C	% Mn	% W	% Cr	% V	% Mo	% CO	% CB
1	18-4-1 High Speed	0.71	0.25	18.0	4.0	1.0	—	—	—
2	1.5 C High Carbon, High Chromium	1.55	0.25	—	12.0	0.50	0.90	—	—
3	Moly-Tungsten High Speed	0.82	0.25	6.00	4.0	2.0	5.0	—	—
4	2.25 C Oil Hardening High C, High Cr	2.25	0.20	—	12.0	0.80	—	0.50	—
5	2.25 C Air Hardening High C, High Cr	2.25	0.30	—	12.0	0.80	0.90	—	—
6	High V Moly-Tungsten High Speed	1.27	0.25	5.5	4.5	4.0	4.5	—	—
7	High V, High Co High Speed	1.50	0.25	12.5	4.75	5.0	—	5.0	—
8	Experimental Columbium Steel	1.30	2.00	—	1.50	—	1.00	—	3.00
9	Cast Alloy	2.30	2.00	16.0	27.0	—		— 45.0 + 4% Ta + 0.5% B	
10	Sintered Carbide	T. C. with approx. 20% Cobalt binder							

HEAT-TREATMENT AND HARDNESS DATA

Comp. No.	Code Letter	Type of Treatment	Austenizing Temp., F	Quenching Medium	Tempering Temp., F	Rockwell C Hardness
1	A	Salt Bath	2325	Salt-1100 F	1050	65.6
1	B	Pack Carburize	1950	Oil	1025	63.0
2	A	Bright Harden in Dissociated NH_3	1850	NH_3 Atmos.	212	63.8
3	A	Salt Bath	2230	Salt-1100 F	1050	64.7
3	B	Pack Carburize	1950	Oil	1025	65.0
4	A	Bright Harden in Dis. $NH_3 + 1\frac{1}{2}\%$ CH_4	1750	Oil	300	63.4
5	A	Bright Harden in Dissociated NH_3	1800	NH_3 Atmos.	212	64.0
6	A	Salt Bath	2225	Salt-1100 F	1050	65.4
6	B	Pack Carburize	1950	Oil	1025	65.0
7	A	Salt Bath	2260	Salt-1100 F	1025	66.5
7	B	Pack Carburize	1950	Oil	1025	65.0
8	A	Bright Harden in Dissociated NH_3	1550	NH_3 Atmos.	350	63.0
9	A	None	—	—	—	57.5
0	A	None	—	—	—	84*

* Rockwell A Hardness

BURR HEIGHT & PUNCH WEAR at 80,000 Operations

Comp. Number	Code Letter	Burr Height Index	Punch Wear Index
1	A	19.5	14.5
1	B	14.3	10.0
2	A	18.8	13.5
3	A	14.0	10.0
3	B	10.0	7.0
4	A	17.7	12.5
5	A	12.5	9.8
6	A	20.2	14.0
6	B	13.9	10.0
7	A	15.7	14.0
7	B	12.5	10.0
8	A	14.2♁	23.0
9	A	1.8	1.8#
10	A	1.8	1.8#

 # 80,000 operations are not sufficient to detect difference between cast alloy and carbide
♁ Values for Composition 8 represent only 20,000 operations

sitioning the punching so the microscope can be focused directly on the burr, and burr height measured with a calibrated eyepiece; 2) an optical device known as the "Burrocope"; and 3) specially adapted micrometers.

Feeling is not worthy of consideration for a controlled die life test, and the simple micrometer is unsatisfactory because varying positions of the sample between the anvils or varying pressures produce unreliable measurements.

An intensive statistical analysis of results obtained by optical methods, and with a simple bench-type dial gage micrometer with constant load of the movable anvil, revealed that the latter method provides accurate, reproducible indications of burr height. This method was used for measuring the samples reported here.

Test Procedure Used

After the tools have been fitted into the die shoes, the punch press is carefully adjusted for alignment and smooth, accurate action, the die is mounted in the press, and punching is started.

Sample punchings are secured from each punch-and-die pair at the start of the run, and at regular intervals thereafter until the run has been completed. Punches are then removed from the holder and the amount of wear measured with a low-power microscope.

Burr height of the samples at each stage of the operation is measured, and the data used to plot a curve of burr height versus number of operations for each tool material. These curves indicate progress of wear.

The data obtained confirm the marked superiority of carbides and cast non-ferrous alloys over conventional tool steels. This has been reflected in the tremendous increase in the use of carbide for high-activity lamination dies in recent years. The number of operations used for the tests was not sufficient to test the carbide and cast alloy dies to destruction, that is, until an excessive burr was developed. However, other tests have shown that cast non-ferrous alloy does not have as much wear resistance in punching as does carbide.

The consistent superiority of the carburized high-speed steels over the high-speed steel with conventional heat-treatment, and over the high-carbon high-chromium types, is perhaps the most important fact revealed. There are many applications where low or medium activity of a particular punching does not justify the increased cost of construction of a carbide die, and on these applications large savings can be realized through use of the best possible tool steel and treatment to reduce maintenance expense.

Based on the results of these tests, Westinghouse plans a comprehensive development of the use of carburized high-speed steels for lamination dies.

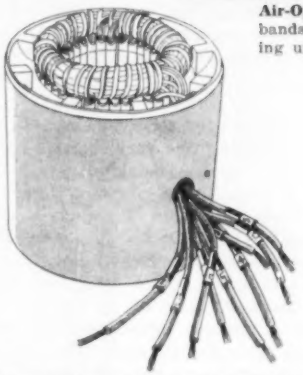
CRIMPING MACHINE TAGS MOTOR LEADS

Numbered metal bands clamped around wire leads by an AMP terminal-clamping machine make sure that leads can be identified at any time during repairs or connection changes on Hoover motors in the field. Mechanical banding saved 16% in material, 56% in labor, and produces 1200 coded leads per hour

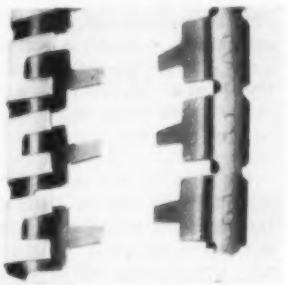
Air-Operated crimping machine straps steel bands around motor leads, making each fastening unifrom. Number die can be changed

WIRE IDENTIFICATION on motors when terminals are loosened, lost, or damaged is conventionally taken care of by tape or metallic bands, hand-assembled to each lead during manufacture. The trouble with this method is that tape becomes dirty, greasy, and wet, resulting in unreadable codes. Metal bands, too, cause trouble because large stocks of standard tags must be kept up, and constant checking must be maintained to insure proper attachment.

To get away from haphazard identification of motor leads, the K-C division of the Hoover Company utilizes preformed tab rolls feeding into an Aircraft-Marine-Products machine made for joining solderless terminals to wire ends. Production is fast, positive, and neat. Simple adjustments of the die members change the code as desired. To date not one case of tab separation from wire lead has been reported.



Identification of nine wires brought out from motor winding is quick and positive when bands are joined permanently to wires



Code bands show single-digit number to identify leads in motor circuit. Stock is coiled to feed into machine, is stamped before clamping

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Tips FOR TOP SHOP MEN

366 One old-time shop manager, taking over from a tough and unapproachable predecessor, changed the atmosphere completely by saying: "When you have a problem, come in and see me. There's no frost on my doorknob!"

367 If you're planning to introduce a labor-saving method that will displace men, and you know there'll be a kickback, get it set to go anyway. Then wait for "evaporation"—normal quits and dismissals—to cut your working force to the newer, lower, level. There'll be no trouble—if your men trust you and the company.

368 There's always a way. Remember the college that got a bequest of several hundred thousand dollars for a new girls' dormitory—which the will stipulated must be surrounded by a 20-ft wall. A smart trustee suggested the bequest be accepted and the dorm be built—with the wall in a 20-ft trench. That satisfied the will, yet met modern standards.

369 Every time you try something new, somebody will call it "a dangerous precedent." Remember that everything new is either wrong or a dangerous precedent to the timid. If you let such reasoning sway you, you'll never do anything new. Only ideas that aren't "dangerous precedents" are the duds.

GOOD CARBURIZING PRACTICE

III...Production of Carburizing and Carrier Gases

Successful gas carburizing requires careful control of the various elements contained in the gases. Here is information on the operation of gas generators and furnaces to obtain the desired properties

BY T. A. FRISCHMAN
Chief Metallurgist, Axle Division
EATON MANUFACTURING CO.

THERE is little doubt that carburizing with straight natural gas is the simplest and most economical of the various gas carburizing methods. If rigid avoidance of fairly high carbon concentration in the case is not necessary, a straight carburizing cycle, omitting a diffusion period, can be used. The natural gas is simply admitted at a safe furnace temperature, above 1300 F, at a high rate of flow, then cut back until the contents of the furnace approach the carburizing temperature.

The flow is reduced to avoid prematurely carburizing the more exposed parts ahead of the inner, or covered up, parts. As the furnace temperature and workpieces reach equilibrium, the gas is admitted at a constant rate until the desired case depth is obtained.

If diffusion is employed (the practice of restraining the formation of high-carbon-content cases), gas is cut off at about two-thirds the duration of the carburizing cycle, the discharge pipe capped, and the contents and furnace allowed to reach equilibrium with the carbon potential of the gas during the last third of the cycle. Thus, the carbon diffuses inward, without building up to an excess much above the eutectoid or 0.85% carbon range in the outer layers of the case.

Carburizing with oil vapors is much the same as with natural gas, and both were commonly used until the introduction of carrier gases. Table I shows the composition of the case produced by two different proprietary carburizing fluids (liquid hydrocarbons) used in a pit-type, electrically heated carburizing furnace equipped with fan circulation. Carburizing conditions were identical, except for the fluids used, and it will be seen that remarkably similar carbon concentration was obtained.

Carrier Gases

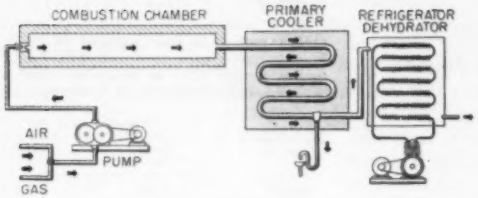
As a rule, carrier gases are not intended to be very reactive with the material being protected or treated in the furnace. One of their important functions is to act as a vehicle for the active carburizing gas such as methane, propane or other gas, and thus make up most of the volume of the mixture introduced into the furnace. Carrier gases have different analyses, depending on whether they are generated exothermically or endothermically. Another function is to purge or sweep out contaminating gases such as oxygen, carbon dioxide and water vapor in carburizing applications. Still another use in carburizing is to act as a diluent to reduce the percentage of methane where large volumes of total gas are needed.

Natural gas, when available, is almost invariably used to supply carbon in the gas carburizing process. It is generally added in measured amounts to the carrier gas, and the mixture admitted into the furnace chamber. However, either can be added unmixed. Where natural gas is not available, propane or butane can be used, as can manufactured or artificial gas. The latter present more of a problem because the percentage of some of their important constituents changes from time to time even though the BTU content remains constant.

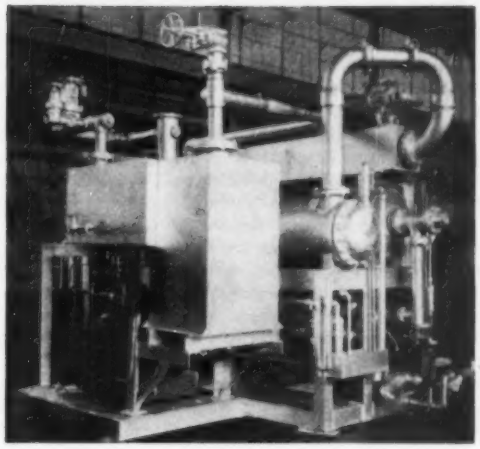
One of the first carrier gases, introduced in the 1930's, was a mixture of one part natural gas to eight parts air burned to incomplete combustion in a chamber without the application of external heat. This type, therefore, is produced by an exothermic gas reaction: exothermic denoting the liberation of heat.

The composition of such a gas would be approximately 9% carbon dioxide, 3% carbon monoxide, 1% moisture, and the balance nitrogen. It borders on the classification of flue gas and its reaction is of a decarburizing nature. To overcome this, a substantial proportion of natural gas, say around 50%, is mixed with the carrier gas to produce the mixture shown in Table II. The objection to this mixture for carburizing is that soot is formed on the work and in the muffle, requiring periodic shutdowns for cleaning. If this is neglected, hard carbon forms on the alloy muffle and will accumulate on the furnace bottom to interfere with the movement of work and contribute to reduced service life of trays, separators and muffles. The virtue of the mixture is that it is simple to control, and produces a case with carbon content and gradient of the character shown in Table III.

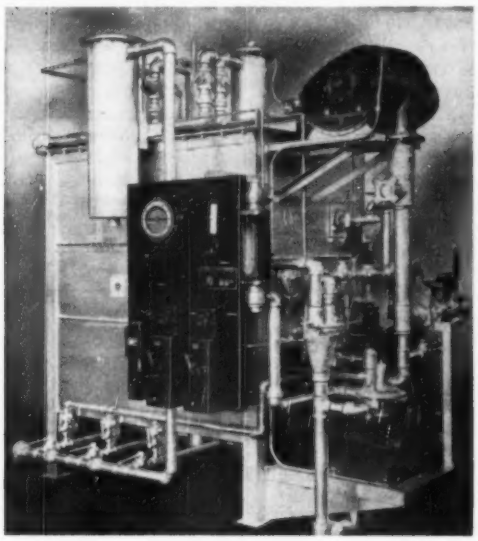
To overcome objectionable features of excessive sooting, an im-

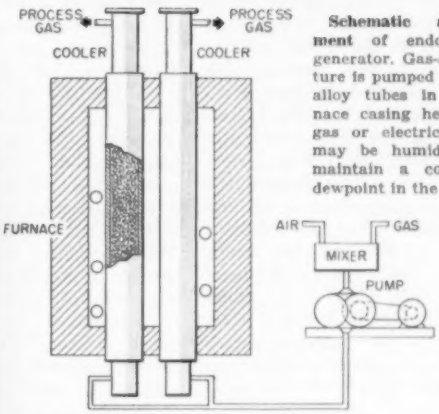


Schematic arrangement, showing the operating principle of the exothermic generator. The gas-air mixture is ignited in the combustion chamber, and the partially combusted products are passed through a cooler and dehydrator before entering the furnace



Exothermic generator built by Surface Combustion Corp. for the production of carrier gas by partial combustion of gas and air. The unit operates at about 2000 F and is heated by the combustion of the gases





Schematic arrangement of endothermic generator. Gas-air mixture is pumped through alloy tubes in a furnace casing heated by gas or electricity. Air may be humidified to maintain a consistent dewpoint in the product

Endothermic generator (Surface Combustion Corp) requires external heat to crack the gas-air mixture. Less soot is produced in the cracking chamber, and the methane content can be cut almost to zero by passing it through a nickel-bearing catalyst

proved gas was developed, analyzing approximately 20% carbon monoxide, 39% hydrogen, 4% methane, traces of carbon dioxide and water vapor, no oxygen, and the balance nitrogen. This is produced by endothermic reaction (absorption of heat), which necessitates cracking it in an externally heated retort. Natural gas, propane or butane are mixed with air and are reacted in the gas generators. When using natural gas, two and one-half parts air to one of gas is the usual proportion. To this carrier gas is added the desired percentage of active carburizing medium such as natural gas, propane or butane. This type of carrier still contained a rather high methane content which, because of its carburizing action, rendered it unsuitable for clean hardening or annealing of low carbon parts.

Eventually, by using catalysts, one of which contains a nickel compound, in the reaction tubes, it was possible to produce a carrier gas virtually free of methane. This can be used for many other heat-treating operations besides carburizing. The composition of such a gas produced at 1850 F is shown in Table IV, which also shows the composition of the gas in the furnace chamber after adding 12% natural gas.

Gas Generators

Exothermic generators consist essentially of a brick-lined chamber into which definite proportions of air and gas are introduced. This mixture is pumped into the combustion chamber where it is ignited and burns to incomplete combustion, at the same time heating up the unit.

As the unit becomes hotter, the composition of the gas changes until a maximum temperature of approximately 2000 F is reached. When equilibrium between temperature and gas composition, is attained, the process continues as long as definite proportions of air and gas are supplied, forming a gas of constant chemical composition. No temperature control is necessary. The hot gases are then water cooled in heat exchangers to the dewpoint of the ambient incoming water temperature. Further treatment of the gas is often employed, but this is not usually necessary where the prepared gas is fortified with high percentages of natural gas.

The endothermic generator differs from the exothermic, since heat must be supplied to react the mixture of predetermined amounts of gas and air. This generator also contains a chamber for the gas reactions, but this is heated externally by gas or electricity. The cracking temperature must be accurately controlled, usually at around 1850 F. Definite proportions of gas and air, properly mixed, are admitted into the cracking chamber, which consists of one or more heat-resisting alloy tubes heated externally in a brick-lined furnace shell. Some units are manufactured to crack the mixture at temperatures from 2000 to 2200 F, it being claimed that a greater volume of prepared gas is obtained per cubic foot of raw gas used. Another contention is that the carbon burnout problem is alleviated by reducing the tendency for soot to form in the cracking unit.

To keep the dewpoint of the resultant gas as constant as possible, the admitted air for the reaction is frequently humidified to a definite degree so the original dewpoint, as cracked, will not vary as the gas flows to the carburizing furnace. The cracked gas passes through the catalyst, which assures virtual elimination of any remaining methane. Thus, with the methane content controlled from this source, definite additions of methane in the form of natural gas or other hydrocarbons, can be made to render the composition of the carburizing gas constant, when introduced into the furnace chamber.

Factors in the Process

As mentioned above, the methane content of the gas carburizing furnace atmosphere will depend upon the source of the gas and whether it is used undiluted or mixed with carrier gases. There is no arbitrarily fixed percentage of methane necessary to obtain carburized cases, but the percentage does become limited where definite case characteristics are desired for certain applications. In large gear shops operating continuous gas carburizers, there is a tendency to desire minimum methane content in the carburizing atmosphere to restrain the formation of residual austenite. With case depths up to 0.040 in. the problem is not of much consequence, but as case depths of 0.050 to 0.070 in. are produced, carbon concentration in the outer surface of the case reaches the neighborhood of 1.10% quite easily unless the methane content is kept down to around 1 to 2% in the furnace atmosphere.

After cleaning carbon from the furnace, it is a good plan to start with about 7 to 10% methane for from 5 to 10 hr, or until some resooting occurs. This will make carbon available for the required carburizing reactions. After equilibrium between the carbon potential of the gas and the condition of the brickwork in the chamber has again been reached, the methane content may be cut back to normal. After the furnace settles down to regularity, a methane content of from 1 to 7% is generally aimed for.

In addition to methane content, the type of steel, carburizing temperature, quenching temperature and cooling rate enter into the formation of retained austenite. And even if this does not form, other difficulties such as carbide networks, massive carbides, grinding troubles, or cases that chip or spall easily are often related to too high a carbon content. To avoid these troubles, careful attention must be given to the methane content.

Studies by one manufacturer of

Table I

Carbon content of case produced at 1650 F. in pit-type furnace. Steel SAE 4620. Total time in furnace 9 1/2 hr. Using two different carburizing fluids (liquid hydrocarbons)

Depth below surface in.	Carbon content % Fluid A	Fluid B
0.0025	1.08	1.07
0.005	1.03	1.03
0.010	0.97	0.98
0.025	0.68	0.68
0.050	0.30	0.29

Table II

MUFFLE GAS COMPOSITION

Mixture of 50% natural gas and 50% combusted gas resulting from burning one part natural gas to eight parts air.

Carbon monoxide	9.6
Carbon dioxide	0.0
Oxygen	0.2
Hydrogen	25.2
Methane	27.4
Nitrogen	balance

Table III

Carbon content of case produced at 1700 F. Steel SAE 4620. Total time 13 hr. Carburizing medium shown in Table II

Depth below surface in.	Carbon content %
0.0025	1.09
0.005	1.08
0.010	1.02
0.025	0.80
0.050	0.42

Total case depth measures 0.060 in. by the fracture and etch method.

Table IV

Composition of endothermically reacted gas 2.5 parts air to 1 part natural gas produced at 1850 F.

Carbon dioxide	0.0 %
Carbon monoxide	20.6 "
Oxygen	0.0 "
Methane	0.8 "
Hydrogen	41.5 "
Nitrogen	balance
Dew point	0°F.

After adding 12% natural gas to the above generator gas, the furnace mixture analysis became—

Carbon dioxide	0.0 %
Carbon monoxide	17.6 "
Oxygen	0.0 "
Methane	7.6 "
Hydrogen	43.9 "
Nitrogen	balance
Dew point	+17°F.

gas generating equipment indicate that the dewpoint of a carburizing gas will foretell changes in the carburizing reaction ahead of any changes in the constituents of the gas.* In other words, its sensitivity is far greater than that indicated by a periodic gas analysis. By keeping the dewpoint within a range of +10 F to +25 F, the process can be controlled within the desired limit for case depth and carbon concentration.

Dewpoint Control

Dewpoint can be defined as that temperature on cooling at which moisture or water vapor will condense out of a gas. Dewpoints of gases vary considerably, depending upon their chemical composition. For instance, a gas produced exothermically will have a dewpoint no lower than the water used for cooling it in the heat exchanger after the reaction, because high percentages of moisture are formed during burning of the gas. On the other hand, an endothermically produced gas will have much less moisture remaining in the reacted gas, the available oxygen forming carbon monoxide rather than combining with the hydrogen to form water vapor.

Control of moisture content is achieved by correct balancing of air-gas ratios to prevent either the formation of carbon dioxide, or excessive sooting of the reaction chamber, or in other words, cracking either too lean or too rich a mixture. In some instances, low percentages of carbon dioxide are permissible and are actually desired in some plants, but rarely exceed 0.50%. Natural gas usually has a low dewpoint, in the neighborhood of —30 F but can vary as high as +30 F.

Amorphous carbon (soot) is one of the less desirable features of gas carburizing. It becomes a nuisance within the furnace carburization chambers and also fouls the work. It also forms in certain types of endothermic generators, giving rise to a burnout problem. Control is possible, and steps must be taken to retard its formation, as well as to remove it. As mentioned previously, it forms when the methane content is fairly high, or when there is more carbon than is required by the steel to produce carburization.

When the carburizing gas consists of a mixture of 50% natural gas and 50% exothermic gas, it is necessary to remove the contents, workpieces and trays every two weeks, and spend about four hours scraping or burning out the deposited carbon, some of which is loose and some rather hard. If this is not done regularly, the carbon will build up and become so encrusted that it is difficult to remove thereafter. Another disadvantage of carbon build-up is the retarding effect on heat transfer. The soot also has a tendency to cling to rough, unmachined surfaces, and to deposit in crevices and fillets, and has been known to be heavy enough to cause irregular light cases and improperly hardened parts, through its insulating effect. Therefore, it is vital to maintain the process under control so the natural gas is always added to the diluent gas in the proper proportion and so the diluent gas composition remains constant.

Soot in Pit Furnaces

There is also a soot problem in connection with the operation of pit- or rotary-type furnaces, either with or without fan circulation, when using natural gas or oil vapors. Some plants use an inspirator or suction apparatus to pull out the carbon deposit, while others find it more feasible to burn it out between charges. Others rely on long-handled scoops to remove carbon deposit.

Some pit-type furnaces are so constructed that if loose carbon is allowed to accumulate in the bottom of the retort, circulation of the carburizing gases eventually ceases through plugging up, resulting in improper carburizing action. Heavy deposits of soot on the work are objectionable also from the operator's point of view. He has to handle sooty pieces when unloading work which has been chamber cooled, as does the operator who performs the subsequent reheating and hardening operation. Many continuous, as well as pit and rotary furnaces, are now being altered to use an endothermic reacted gas, plus some type of gas which yields methane, to solve the problem.

Even though endothermically reacted gases are used, the soot problem has to be reckoned with. For instance, some gas generators are customarily operated in such a manner that carbon eventually builds up and interferes with holding the range of the dewpoint within prescribed limits. The generator must then be reconditioned, which means that carburizing in the furnace must stop unless additional generating capacity is available. Air is passed through the generator, maintained at its regular temperature of about 1850 F, until analysis shows that no more carbon dioxide is present, indicating that the deposited carbon has been burned away. If heat-treat operations are suspended over week-end shutdowns, this affords a good opportunity to burn out the carbon.

Furnace chamber carbon burnouts are not necessarily made as frequently as generator burnouts because the deposits do not have too much effect on the gas composition within the furnace, nor is deposited carbon as harmful in the furnace chamber as it is in the generator. In fact, too clean a furnace frequently takes a longer time to purge and condition for regular productive work.

About every four to six months some plants shut down their radiant-tube gas carburizers, and vacuum clean the inside. Deposited carbon on top of the tubes, around the supports, and on the bottom of the chamber, which has not been completely burned out in periodic treatments, is thus removed, together with any oxides or scale that has formed from the trays, radiant tubes and furnace alloy. Moreover, this affords a good chance for inspection of the furnace inside. If carbon burnout or vacuum cleanings are neglected, pitting of the furnace alloy results and thus acts to hasten failure.

(The next part of this series will appear in an early issue. Ed.)

DeCoriolis, E. G., O. E. Cullen, and Jack Huebler, Carbon Concentration Control. Trans. American Society for Metals, Vol. 38, p. 659 (1947)

ROUND TABLE

He Who Pays the Piper

"Here's a good question for you, Ed: I just heard of a small family-owned Danish company that paid its men piece-work rates before the war. The plant was somewhat behind the times. One day the owner noticed that a lathe hand was making about twice as much as anybody else in the shop. He went down to see why—and found the fellow running a lathe faster than he'd ever seen one run before. The work was good, too!"

"What do you mean, Al, a lathe shark in a little plant, and rates set for normal guys?"

"Wait, Ed, until I finish telling the story. The owner immediately started to yell that the lathe and tools would be ruined. The lathe hand stopped the job and showed him the tool. It was a carbide bit."

"You mean the owner had never heard of carbide? How come his plant was using 'em?"

"His *plant* wasn't—only this one man. Seems the fellow had asked his foreman to get carbides and gotten turned down—so he went out and bought his own. Said it was his business what tools he used—and if he got a walloping big pay check, that was his too—he bought the tool."

"But, Al, he was using a company machine, and taking a chance with the owner's property by running it so fast. Probably using more power, too. What did the boss do?"

"What could he do? He was getting his production, wasn't he? If overhead cost means anything, he was getting it cheaper. And you should know by now that the proportional rise in power used wasn't near as much as the increase in output. Nope, the only added cost was the tool—and he didn't buy that."

"But, Al, he owned the machine that the tool was used on! The lathe hand couldn't do a thing without it—and his investment was only a couple of bucks while the owner's was several hundred times as much. Seems to me they should split the gain."

"Why? If the owner put in a new, faster machine, would he give the lathe hand more? No, sir, Ed, it's the guy who pays the piper that calls the tune."

"Not in my shop, he wouldn't! He'd treat my machines my way—or get out."

"You mean you'd fire him for doing a better job, then go back to the older, slower way, Ed?"

"No, not that—I'd buy the carbides myself."

"Then you'd be guilty of stealing a man's idea and using it without paying for it. That's what used to cause so many fights—and why the patent system was invented."

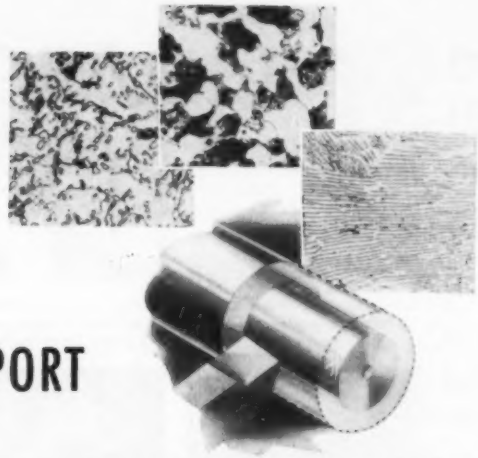
"No, wait a minute, Al. The guy didn't invent carbides; he just started using 'em. Why couldn't the owner start the same way?"

"He could, Ed, but the point is that he hadn't. The lathe hand had. He spent his own dough to buy the tool, and was certainly entitled to any return on his investment. That's free enterprise."

"Next thing you'll say is he ought to have gotten a bonus from the owner for saving him overhead."

"I hadn't thought of that, but he sure should. The suggestion system ought to work both ways."

WHO DESERVES THE INCOME *in a case like this—the owner or the worker? What would you do in a similar case? (This situation, incidentally, is a true one.) Your ideas and opinions will be appreciated by others. Discussions of earlier topics appear on later pages.*



AIR FORCE
CURTISS-WRIGHT
FORD
METCUT
} REPORT

Proves MACHINABILITY Depends on Microstructure

BY RUPERT LE GRAND, ASSOCIATE EDITOR

HOW can one predict accurately the optimum rate for machining a given material? For with such data known, the shop can operate existing machines at their maximum performance or order new equipment with even greater cost-cutting potential.

Because maximum production at minimum cost is a vital objective of mobilization planning, the United States Air Force asked Ford Motor Company to study the problem and draw up a suitable research program. At the invitation of Del Harder, Ford vice-president in charge of manufacturing, representatives of Cincinnati Milling Machine Co., Metcut Research Associates, the University of Cincinnati and Massachusetts Institute of Technology met with Ford manufacturing engineering and metallurgical personnel.

At the outset of the program, R. T. Hurley, while director of manufacturing engineering at Ford, was placed in charge of the program. Mr. Hurley knew that the microstructure of a material and its processing prior to machining determines the optimum machining rate. When Mr. Hurley left Ford to become president of Curtiss-Wright Corporation he took with him the Air Force contract for the study. Thereupon, the various phases of the work were allocated to Ford, Metcut, MIT, and Curtiss-Wright.

The complete study of the machinability of irons, steels and high-temperature alloys has recently been published by the Curtiss-Wright Corp. Because of the mass of material involved, this Special Report summarizes the work done on irons and steels, plus additional data and its practical application by Ford to the manufacture of automobile parts at less cost.

Data on high-temperature alloys, as developed by Curtiss-Wright, will be published shortly.

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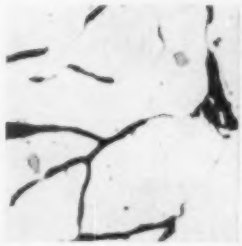
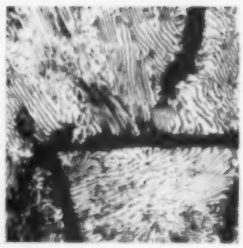
RELATIVE MACHINABILITY OF GRAY (Flaky Graphite) CAST IRON in order of decreasing tool life



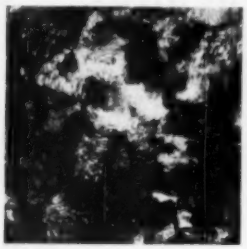
INDEX: 20
Ferrite, graphite
120 Bhn. Full anneal

INDEX: 10
50% ferrite, 50% pearlite, graphite. 150 Bhn. Part ann.

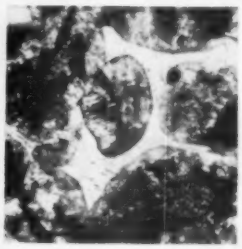


INDEX: 2
Coarse pearlite, graphite
195 Bhn

INDEX: 1.5
Medium pearlite, graphite
215 Bhn

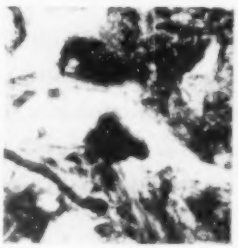


INDEX: 1
Fine pearlite, graphite
218 Bhn

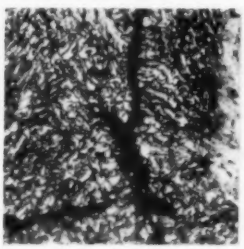


INDEX: 1
Fine pearlite, 5% steadite, graphite. 197 Bhn

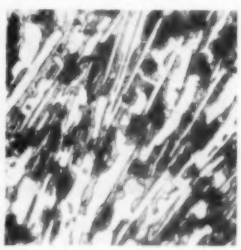
Nine typical microstructures exhibited by gray (flaky-graphite) cast irons are presented here accompanied by a tool-life index number for each. A fine pearlitic iron arbitrarily has been assigned a par value of 1. The numbers over the other eight irons represent the relative tool life possible compared to the fine pearlitic iron when machined at the same cutting speed. Data are for carbide cutters only, and at cutting speeds in excess of 300 fpm. All photomicrographs are nital etched; magnification, 500x



INDEX: 0.3
Fine pearlite, 5% free carbide, graphite. 240 Bhn



INDEX: 0.20
Acicular structure
263 Bhn



INDEX: ——
White iron
Bhn over 500

HOW FORD APPLIES MACHINABILITY DATA

IT HAS been aptly said: "Give me the history of a piece of stock and its microstructure, and I can predict for you the best cutting speed and feed." And as a corollary: "Allow me to put the stock into its optimum microstructure, and I will be able to machine it at far greater speed and feed than commonly accepted practice, and get greater tool life." Finally, "By knowing the optimum speed and feed for cutting a given material, I can order machine tools with enormous cost-savings potential."

All this is true, but so many variables can be encountered on any job that it is well to use caution. The Ford Motor Company has extensive knowledge of optimum microstructure of a variety of cast irons, nodular irons and SAE steels. This new knowledge of turning, broaching and drilling the automotive materials is being used to a good extent by Ford in tooling up huge new engine and parts plants. However, these programs cannot be delayed by efforts to make every operation reflect ultimate performance. Hence, most of the emphasis of the machinability program is placed currently on bottleneck or high-cost operations and upon new parts.

In every case a careful analysis is made of the various methods of producing the part from foundry or forge right through machining. In other words, the problem is viewed from all angles: material, redesign of part, heat-treatment, type of machine tool, tool material, coolant, automation, materials handling, in addition to high-speed machining.

It is not difficult to find the reason for cautious, studied appli-

cation of machinability data to the operations of a mass-production plant. Here, it is more important to produce the required number of pieces per day than it is to turn in a brilliant, albeit erratic, performance. The latter can easily come about when exploring unknown areas in the field of high-speed machining. Breakdowns occur from failures of hydraulic circuits, work-clamping devices, bearings, clutches, switches. Vibration and chatter arise from unsuspected weaknesses and lack of precision balance of rotating parts of the machine.

However, if nothing is ventured, the potential cost savings of optimum machining rates won't be realized. Hence, delays and production interruptions through the introduction of high-speed equipment are being avoided by: (1) reference to the experience already gained, (2) the activities of the manufacturing engineering staff, and (3) the practice of running acceptance tests at the vendor's plants, using production quantities of parts. Hence, Ford engineers apply their production know-how to find the "bugs," the vendor has his men and engineers handy to make any necessary changes.

By bringing to bear the experience of the various sections of the manufacturing engineering staff, application of machinability data to cost-reduction studies is blended with other necessary matters. To develop a survey of potential cost savings, many minds attack the problem. Men in the Chemical & Metallurgical Research Department look at it from the standpoints of forging and foundry practice, microstructure, the advantages and economics or normalizing or annealing heat-treatments before machining. They may run machinability tests in a well-equipped laboratory or under production conditions. The Machining Process Department brings to bear its knowledge of machine tools and cutting tools, and works up equipment proposals and process sheets. Minute costs, materials handling, floorspace and installation costs are compiled by appropriate departments. Finally, the operating management of a parts division is handed a reasoned statement of equipment necessary, the daily savings in parts cost, and period to amortize investment.

The new installation may be totally unlike the old one, or the process of manufacture may be different in many respects. Modernization in part design may have been made to accommodate simpler production methods. Operations may be combined to the point at which two machines do the work formerly done by twelve machines. While each job is worked out for the best tool material, Ford is rapidly expanding and pioneering the application of carbides.

How Microconstituents of Iron Affect Machinability

IRONS AND STEELS have many common constituents, but cast iron contains free graphite while steel does not. Constituents of cast iron, as seen in photomicrographs, on opposite page, are:

Flaky graphite—Black streaks (prominently visible in index 20, 10 and 2 irons) indicate flaky graphite. The flakes may be large or small, dependent upon the cooling rate. Large flakes are associated with slow cooling. Free graphite is soft and amorphous and acts in iron as a free machining agent.

Nodular graphite — When free graphite ocurs in the nodular form as in nodular cast iron (see page 114) the iron may be made ductile and it possesses higher strength. The tool life is greatly improved.

Ferrite—The white areas in the 20- and 10-index irons represent ferrite, which is practically carbon-free iron. Free ferrite is present in quantities up to 10% in as-cast irons, and is increased to 50% or more by annealing. The presence of free ferrite is extremely beneficial to tool life as it is the softest major constituent of iron, after graphite.

Pearlite—A pearlitic structure is revealed by alternate black and white stripes, white for ferrite and black for iron carbide. Large grains go with wide lamellar spacing. Usually coarse pearlite is associated with coarse graphite and fine pearlite with fine graphite. Coarse pearlite forms when the cooling rate is sufficiently slow and the iron is not highly alloyed. Fine pearlite is associated with a rapid cooling rate, low carbon content, low silicon content and presence of alloying constituents. Because pearlite is 50% harder than ferrite, it produces shorter tool life.

Free carbide — Definite grain boundaries separate free carbide (white background index 0.3 iron) from other constituents. Free carbide ocurs in irons that have been cooled rapidly, and its formation is accelerated by chromium and vanadium. Presence of even 3 to 5% free carbide is detrimental to tool life.

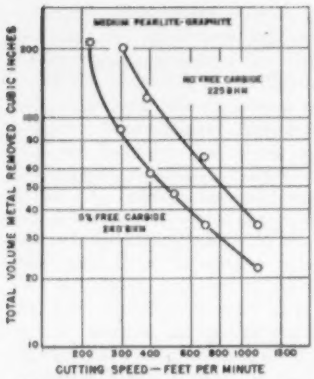
Steadite—White areas with black specks, as seen in right-hand iron with an index of 1, denote steadite. This eutectic composition of iron, phosphorus and carbon is normally found in irons containing more than 0.10% phosphorus. In ordinary cast irons, steadite is present in quantities of less than 5%, then has little effect on tool life.

Acicular structure — A hard, strong iron is produced by adding chromium, nickel and molybdenum, and is difficult to cut.

White iron — Under extremely rapid cooling conditions, as in thin casting flashes, a structure of about 50% fine pearlite and 50% free carbide, with no free graphite, is formed. This structure is very hard and is virtually unmachinable.

The hardnesses of microconstituents in irons determine the abrasiveness of the structure and are the most significant factors affecting tool life. Comparison of the average hardnesses of these materials and tool materials is:

Microconstituent	Knoop Microhardness 100-gr load
Free graphite	20
Free ferrite	240
Pearlite	350
Acicular structure	445
Steadite	950
Free carbide	1500
Sintered carbide	1800
Hardened tool steel	740



Free carbide, in amounts as small as 5%, will adversely affect tool life of cast iron

It is readily demonstrated that while physical properties and machining properties depend on microstructure, they do not depend on each other. Contrary to expectations, changes in microstructure that produce harder and stronger materials will also lead to greater tool life, and higher cutting speeds.

Structure of cast iron and hence its machinability depend on:

1. Foundry practices, including pouring temperature, chills, core washes, moisture in sand, etc.

2. Casting design as it affects section thickness and chemistry

3. Annealing treatments to improve machinability if they do not sacrifice physical properties.

Furthermore, irons of the same microstructure, regardless of chemical composition, section size, cooling rate or physical properties will have approximately equal machining properties. If microstructure is the only reliable guide to machinability of cast iron, the structure must be known in the immediate area to be machined, because the structure may vary.

Milling Cast Irons With Carbides

BECAUSE FACE MILLING is the most important method of finishing iron castings, Field and Stansbury (ASME *Transactions,* Aug., 1947) chose to use this process for developing data on the influence of microstructure upon tool life, surface quality and power consumption.

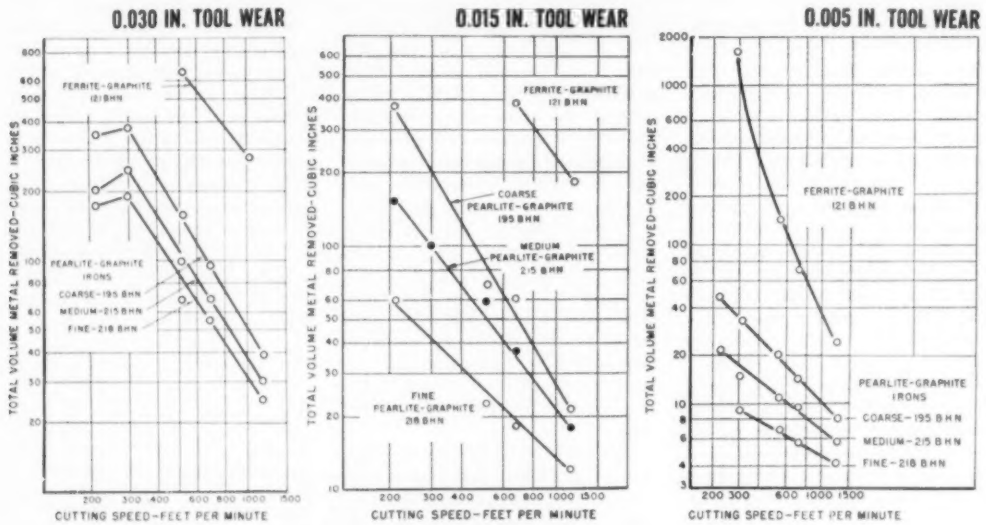
In milling, speed and feed should be chosen to provide the highest production at minimum cost. And here microstructure enters the picture immediately. For the charts for tool wear show that the total volume of metal removed *vs.* cutting speed is definitely affected by the size of pearlite grains. At once, the cost of annealing (if final physical properties are not critical) must be balanced against the higher production rate and greater tool life made possible by heat treatment.

For example, suppose that one assumes an arbitrary tool life of 200 cu in. per tooth as suitable on a production job. A fine pearlitic iron may be machined at 300 fpm, but fully annealed ferritic iron can be processed at 1500 fpm, or 500% as fast. On the other hand, if the cutting speed is fixed at 500 fpm, the increase in tool life is from 85 to 680 cu in., or 800%.

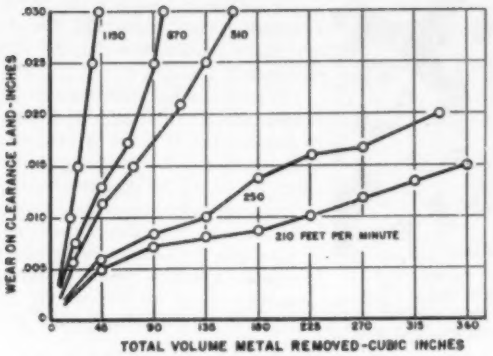
For short-run jobs, cutter regrinding is normally undesirable. Hence to obtain the tool life per tooth, divide the total amount of material to be machined away by the number of teeth in the cutter. Then refer to the chart to find the cutting speed for this tool life.

Suppose we have a production job where the depth of cut differs from the 3/16-in. depth of cut on which the charts were plotted.

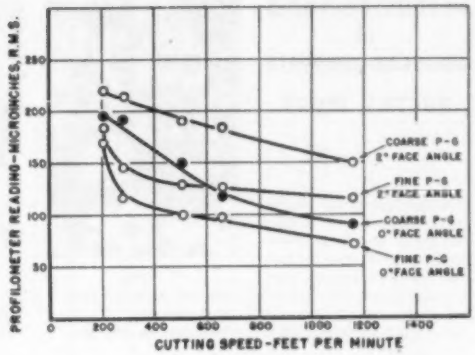
Example: 1000 pcs of coarse pearlitic iron, 5 in. wide by 16 in. long, depth of cut 1/8 in. The



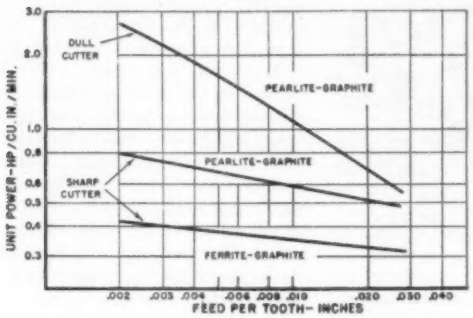
Plan cycle time on production jobs to give best cutter life-machining rate combination. For microstructure to be machined, calculate metal removal per tooth, and tool life for actual time in the cut



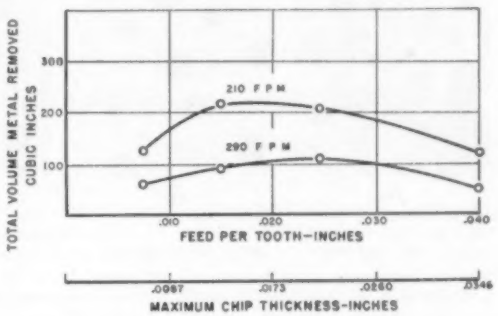
Tooth-wear charts facilitate tool-life interpretations. All tests were made on coarse pearlitic iron at 0.187 in. depth of cut and 0.015 in. feed per tooth



Surface finish improves as cutting speed increases, as structures become finer, and as the face angle is reduced. Breakout decreases with finer structures



Unit power decreases as feed per tooth increases, as the metal is annealed, and when cutter is sharpened. Test made at 220 fpm cutting speed



Feed per tooth is not critical with cast irons. Best range is between 0.012 to 0.025 in. (a chip thickness corresponding to 30° corner angle)

amount of material to be removed = 80 × 1/8 = 10 cu in. per pc, or 10,000 cu in. for the job. If the cutter selected has 20 teeth, the total volume of metal removed per tooth equals 500 cu in. But because the depth of cut equals 1/8 in. or two-thirds of the test depth of cut, the appropriate chart reading equals 333 cu in. per tooth.

From the chart for 0.030 in. tool wear, we find that a cutting speed of approximately 325 fpm will serve for coarse pearlitic iron under the stated conditions. If the material could be put into the ferritic condition by annealing, and the milling machine will provide the proper speed, the job could be cut at 900 fpm.

Surface finish is improved for a given cast iron and cutter by increasing the cutting speed. When the cutting speed is increased from 200 to 1200 fpm, the Profilometer reading drops about 50 to 100 micro-inches. At constant speed, surface finish is improved by using irons of finer structures. At 600 fpm, for example, the Profilometer reading drops from 180 for coarse pearlitic iron to 100 Rms for fine pearlitic graphite iron.

The horsepower required to remove metal at a given rate (hp/cu in./min.) is about the same for all of the pearlitic cast irons and is considerably less for ferritic iron. Unit power decreases as the feed is increased, because of the mechanics of shearing.

Turning of Cast vs. Nodular Iron

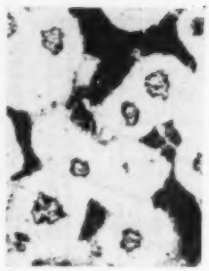
NODULAR GRAPHITE produces higher physical properties in irons than flake graphite. Until recently, only malleabilization produced this form of graphite in iron, and the process requires long treatment. But it has recently been found that additions of magnesium or cerium alloys to the ladle produces irons with nodular graphite in a matrix or pearlite or ferrite. Because the as-cast nodular irons are not limited in size, have high strengths, and possess ductilities ranging from 2 to 22%, the new engineering materials are of considerable interest.

What is the relative machinability of flaky-graphite irons and the new nodular irons? The answer lies in microstructure. The acicular structure in flaky-graphite iron is the hardest and strongest of the series, but it permits a cutting speed of only 150 fpm for a metal removal of 200 cu in. The weakest

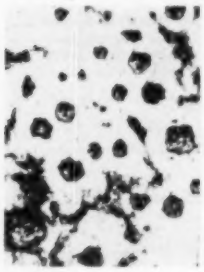
MICROSTRUCTURES of NODULAR-GRAPHITE DUCTILE IRONS

Nodular irons are called 2%, 4%, etc., according to their ductility. Such irons are stronger than the flaky-graphite cast irons, but can be turned at high cutting speeds. All microstructures, 150X

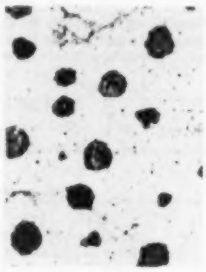
2%
As-cast Nodular Iron
80% pearlite,
20% ferrite. 265 Bhn



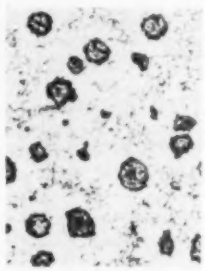
4%
As-cast Nodular Iron
40% fine pearlite,
60% ferrite. 215 Bhn



17%
As-cast Nodular Iron
40% pearlite,
60% ferrite. 207 Bhn



20%
Ann. Nodular Iron
97% ferrite,
3% pearlite. 183 Bhn



22%
Ann. Nodular Iron
100% ferrite. 170 Bhn

nodular iron, but one that is much stronger than acicular iron, permits a cutting speed of 970 fpm for the same tool life.

To ascertain machinability of the several nodular irons, tests were run with carbide tools. These were clamped in a special toolholder providing maximum rigidity and eliminating overhang. Tool angles were: 0° BR, 6° SR, 0° SCEA, 6° SCEA, 6° relief and 0.050-in. nose radius. Kennametal K6 carbide was selected as a tool material representative of general-purpose grades used in industry for the type of cut to be taken.

Test results show that at 200 cu in. per min. metal removal, the following cutting speeds can be realized:

Acicular iron	150 fpm
Fine pearl. graphite	310 fpm
Coarse pearl. graphite	325 fpm
Ferrite, graphite	960 fpm
2% nodular, as cast	200 fpm
4% nodular, as cast	310 fpm
17%, as cast	420 fpm
20% annealed	600 fpm
22% annealed	970 fpm

In these tests, the depth of cut was 0.100 in., the feed 0.010 ipr, and no cutting fluid was used. Tool life is for 0.030 in. wear.

For a 60-min. tool life, the flaky-graphite cast irons showed potential cutting speeds ranging from about 160 fpm for acicular iron to 425 fpm for coarse pearlite, while free ferrite could be cut at 800 fpm. In the case of the nodular irons, for a 60-min. tool life, the cutting speeds range from 225 for 2% nodular to 700 fpm for the 22% nodular.

Considerable improvement in machinability takes place with both classes of irons as the result of annealing. A vast improvement occurs when the matrix structure is changed from pearlite to ferrite, in the case of ordinary cast irons. Although the machinability of the nodular-graphite irons is exceptionally good on the whole, the annealing procedure again produces marked results.

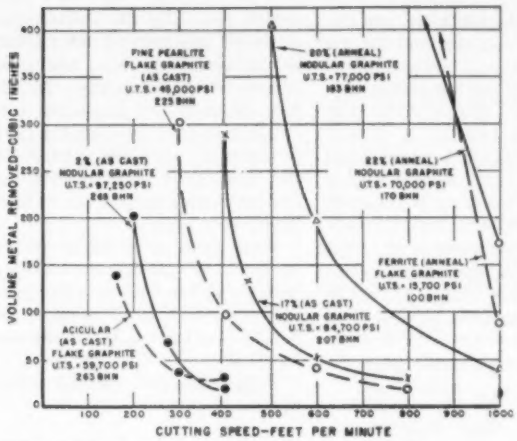
New Methods Needed

The shop man is not free, of course, to anneal irons for an improvement in machinability, unless the physical properties are not critical, and there is no objection by engineering. The nodular irons range all the way from great wear resistance and stiffness for the 2% type to high ultimate strength along with ductility in the 22% annealed nodular. As engineers take advantage of these properties, the shop will be called upon to install equipment and adopt new methods.

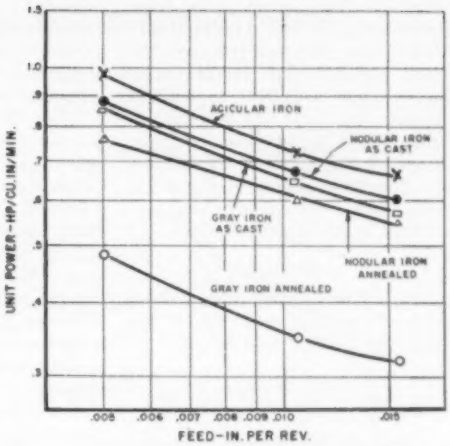
Power requirements for flaky-graphite *vs.* nodular-graphite irons are plotted in terms of horsepower at the spindle per cubic inch of metal removed against feed. With an increase in feed, the power required decreases. And in general, power decreases as the Brinell hardness decreases. Moreover, there is little difference in power

Comparative Properties of FLAKY-GRAPHITE AND NODULAR GRAPHITE IRONS

MATERIAL	CHEMICAL COMPOSITION									PHYSICAL PROPERTIES					
	CARBON	MANGANESE	PHOSPHORUS	SULPHUR	SILICON	NICKEL	MAGNESIUM	MOLYBDENUM	CHROMIUM	BRINELL HARDNESS	ULTIMATE TENSILE STRENGTH, psi.	YIELD POINT, psi.	% ELONGATION, 2 in.	% AREA REDUCTION	CUTTING SPEED, fpm. for 200 cu. in. TOOL LIFE
NODULAR GRAPHITE IRONS															
2% as cast	3.33	.45	.11	.018	2.66	1.65	.079	—	—	265	97,250	79,000	2.0	1.5	200
4% as cast	3.41	.42	.09	.014	2.82	.81	.073	—	—	215	93,000	72,000	4.0	3.5	310
17% as cast	3.82	.23	.082	.018	3.04	1.13	.082	—	—	207	84,700	69,800	17.5	16.5	420
20% annealed	2.79	.53	.09	.014	2.76	1.59	.071	—	—	183	77,000	62,000	20.0	21.0	600
22% annealed	3.69	.27	.045	.014	2.64	1.15	.060	—	—	170	70,000	56,000	22.0	22.0	970
FLAKE GRAPHITE IRONS															
Acicular iron	2.78	1.03	.12	.064	2.30	2.11	—	.32	—	263	59,000	——	——	—	150
Fine pearlite	3.22	.62	.08	.097	2.10	.85	—	—	.64	225	45,000	——	——	—	310
Coarse pearlite	3.17	1.10	.10	.108	2.44	—	—	—	—	195	35,000	——	——	—	325
Ferrite (annealed)	3.47	.35	.05	.133	1.62	—	—	—	—	100	15,700	——	——	—	960


VOLUME METAL REMOVED-CUBIC INCHES
CUTTING SPEED-FEET PER MINUTE
FINE PEARLITE FLAKE GRAPHITE (AS CAST) U.T.S.=40,000 PSI 225 BHN
20% (ANNEAL) NODULAR GRAPHITE U.T.S.=77,000 PSI 183 BHN
2% (AS CAST) NODULAR GRAPHITE U.T.S.=97,250 PSI 248 BHN
22% (ANNEAL) NODULAR GRAPHITE U.T.S.=70,000 PSI 170 BHN
FERRITE (ANNEAL) FLAKE GRAPHITE U.T.S.=15,700 PSI 100 BHN
17% (AS CAST) NODULAR GRAPHITE U.T.S.=84,700 PSI 207 BHN
ACICULAR (AS CAST) FLAKE GRAPHITE U.T.S.=59,700 PSI 265 BHN

Select the best combination of tool life and machining rate by reference to this chart and the ones below. Ductile nodular irons give high metal-removal rates



Power requirements are given for sharp tool. If cycle permits wear land exceeding 0.030 in., power consumption rises sharply

requirements between flaky- and nodular-graphite irons of the same hardness level. Note that the data apply when a sharp tool is used. A dull tool requires as much as three times the power. Reserve capacity must be provided if the tool-regrinding cycle is such that there is a chance of exceeding the 0.030-in. wear limit. Surface finish improves with cutting speed.

Turning of Nodular Iron vs. Cast Steel

FROM EXAMINATION of the physical properties of nodular irons, the question arises: "Can nodular irons replace cast steels." From the shop standpoint, such replacement could be extremely economical, in respect to both machining rate and amount of material that need be removed. New processes of casting are now coming into experimental use, whereby as much as 70% of machining is saved.

To learn how nodular irons machine in the as-cast and annealed conditions, tests were run in comparison with a cast steel. Properties of these materials were:

NODULAR CAST IRON

As-cast structure: hardness, 255 Brinell; ultimate tensile strength, 72,000 psi, elongation, 0%.

Annealed at 600 F: hardness, 269 Brinell; ultimate tensile strength, 82,500 psi; elongation 1%.

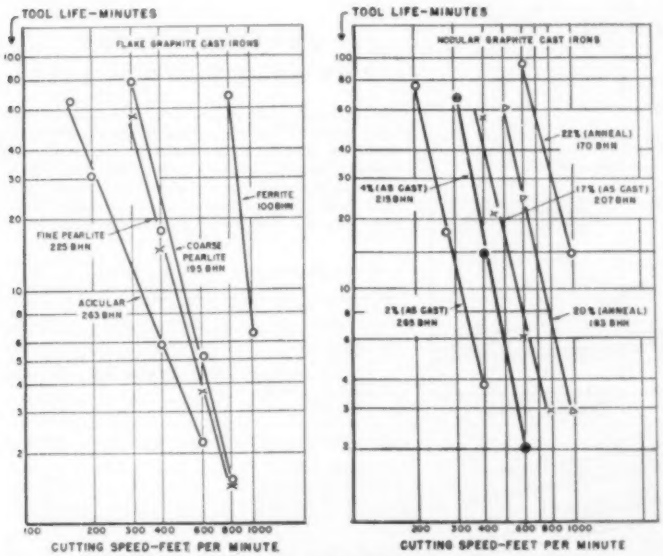
Annealed at 1320 F: hardness, 237 Brinell; ultimate tensile strength, 74,650 psi; elongation, 0%.

CAST STEEL

Annealed at 1750 F: hardness, 269 Brinell, ultimate tensile strength, 85,750 psi, elongation 0%.

These materials were chemically compounded to give a stiff, wear-resistant material.

Tool life was evaluated both with and without 40:1 coolant, and for T-1 high-speed steel, Tantung G and various grades of carbides. For the last, suitable grades were determined by running tool wear tests at 250 fpm, 0.100 in. depth of cut, and feeds of 0.005, 0.010 and 0.015 ipr. In turning cast steel,



Nodular irons allow longer tool life, on the whole, than flaky-graphite irons. Prospects are fewer work stoppages and stronger products when using these new materials

less tool wear occurs at all feeds when using the steel grades of carbides. Here K6 and 44A gave the best results, and further tests were made with K6. In turning nodular iron, less tool wear occurs when using the cast-iron grades of carbides. The K2S and EM carbides produced the best results, and EM was chosen for further testing.

Tool angles selected were:

CARBIDES

Style AR, +6° side rake, 0° back rake, 0° SCEAR, 6° ECEA, 6° relief, and 1/32-in. nose radius.

TANTUNG G

Same as HSS steel.

HIGH-SPEED STEEL T-1

Style AR, +4° side rake, 0° back rake, 10° SCEA, 10° ECEA, 6° relief, and 0.040-in. nose radius.

Coolant had a pronounced effect when turning nodular iron at various speeds and feeds. At 60 fpm, 0.009 ipr and 0.100-in. depth of cut with HSS tools, tool life was 164% better than without coolant. Tool life drops off rapidly with speed increase when such a heavy feed is used.

Plunge-cutting tests with HSS tools were made for the purpose of simulating form cutting. At a heavy feed like 0.012 ipr, the existence of casting skin and the use of coolant are not important, except at lower cutting speeds, say between 30 and 40 fpm. At 75 fpm, practically no tool life is obtainable if casting skin is present and no coolant is used. With a feed of 0.003 to 0.009 ipr, there is a marked difference between tool life obtainable when coolant is or is not used. With an unmachined casting, the tool life is 50% greater at 0.003 ipr if coolant is used than when no coolant is employed, while turning a casting with skin removed.

Presumably on the assumption that plunge cutting would be done dry, a constant-rate machining curve was developed for the feed and speed combinations to remove 1.8 cu in. per min. When cutting dry, this curve shows that the optimum combination is 0.012 ipr and 33 fpm.

At 40 fpm and feeds of 0.010 to 0.025 ipr, HSS tools perform better on annealed nodular iron than on cast steel.

Tool life of carbides was checked at two cutting speeds: 150 and 300 fpm. It was found that nodular iron, as-cast or anenaled, has better machinability than cast steel at 150 fpm over the whole range of feeds. The 600 and 900 F treatments produced about the same degree of machinability. At 300 fpm, the cast steel had better machinability than the nodular irons at low feeds, say 0.005 to 0.015 ipr. But at feeds of 0.020 to 0.035 ipr, and all cutting speeds, the nodular irons were superior.

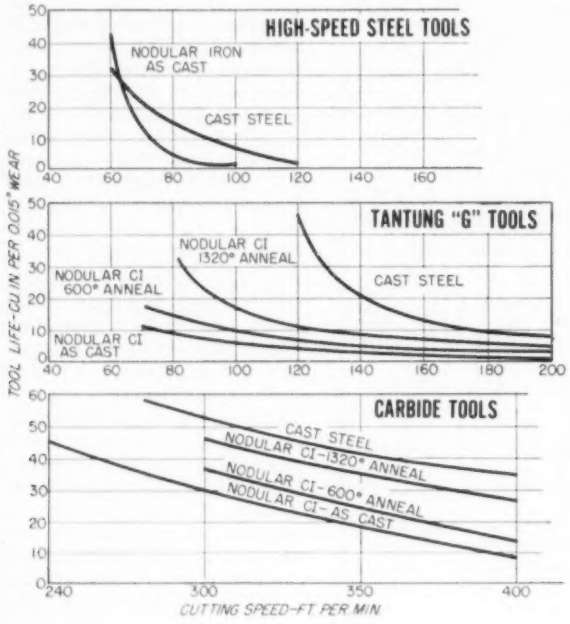
With Tantung G tools, at low feeds of 0.010 ipr cast steel showed better tool life than nodular irons in the normal speed range of 80 to 200 fpm for the cast-alloy tool material.

Suggestions for practical speeds and feeds are:

	HSS	Tantung	Carbide
Annealed Nodular Iron	60 fpm 0.015 ipr	90 fpm 0.015 ipr	150 fpm 0.030 ipr
Cast Steel	85 fpm 0.010 ipr	130 fpm 0.010 ipr	250 fpm 0.015 ipr

There is no absolute optimum set of speeds and feeds for a given tool. Their selection must be governed by the desired machining rate and the tool life in minutes.

Curves for feed *vs.* tool life and cutting speed *vs.* tool life failed to show optimum points for "as-cast" nodular iron. For this reason, constant-rate machining curves were plotted to show definite peaks.



CUTTING SPEEDS FOR 60-MIN. TOOL LIFE

These charts show tool life in cu in./0.015-in. tool wear *vs.* cutting speed, when machining at 0.009 ipr and 0.100 in. depth of cut. Estimated cutting speeds for 60-min. tool life for 0.030-in. wear land on tools are given below. These speed and feed combinations are not necessarily the best for the associated machining rates.

Work Material	Tool Material	V_{60}
Cast steel	Vascoloy EM	325 fpm
Nodular iron:		
1320 F anneal	Kennametal K6	310 fpm
600 F anneal	" "	290 "
As cast	" "	275 "
Cast Steel	Tantung G	130 fpm
Nodular iron:		
1320 F anneal	" "	108 "
600 F anneal	" "	88 "
As cast	" "	68 "
Cast Steel	HSS (T-1)	86 fpm
Nod. Iron, as cast	" "	72 "

From the constant-rate machining curves, one sees that the optimum feed rate is 0.020 ipr for removal rates of 5 and 6 cu in. per min. and 0.025 ipr for a rate of 8 cu in. per min. Corresponding cutting speeds are 210, 250 and 265 fpm, respectively. Obviously, the tool life in terms of metal removal decreases sharply for increasing machining rates.

For convenience, the data on which the constant-rate machining curves were based were limited to a wear land of 0.010 in. The comparative figures for this degree of wear and the normally accepted limit between regrinds are tabulated.

It is estimated that a 60-min. tool life for 0.032 in. wear will be produced with a constant machining rate of 3 cu in. per min. A few feed and speed combinations giving this machining rate are: 0.009 ipr—278 fpm; 0.012 ipr—208 fpm; 0.015 ipr —167 fpm, and 0.020 ipr—125 fpm.

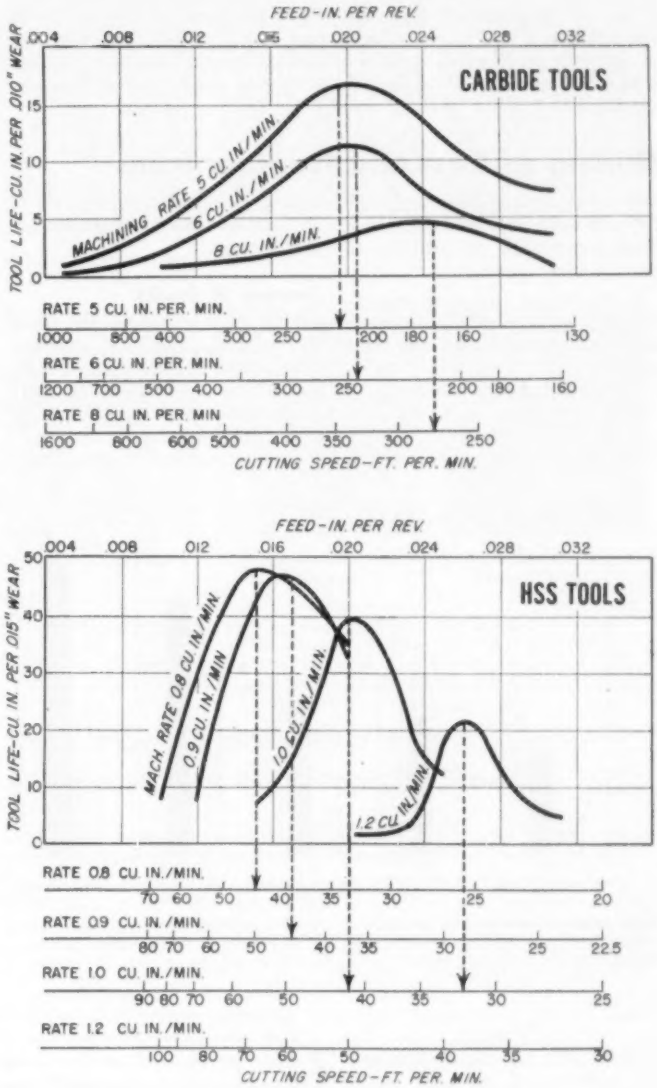
For carbide tools, greater production is gained in all cases by an accompanying decrease in tool life. The tool engineer must therefore balance the loss in production for tool changes against gains for higher metal-removal rates in figuring what speeds and feeds he can use for a specific setup.

The constant-rate machining curves for high-speed steel on as-cast nodular iron are based on 0.8, 0.9, 1.0 and 1.2 cu in. per min., all at 0.015 in. tool wear. The comparative figures for this degree of wear and 1/32-in. wear are tabulated.

To obtain 60-min. tool life, a machining rate of 1.2 cu in. per min. is satisfactory.

Annealing treatments improve machinability of nodular iron. Constant-rate machining curves at 5 cu in. per min. show that cast steel and as-cast nodular iron are machined at an optimum feed of 0.020 ipr and cutting speed of 210 fpm. Comparable tool life figures are: as-cast nodular iron 20 cu in. for 0.010-in. wear, and for cast steel 27.5 cu in. But no definite peaks were found with nodular irons annealed at 600 and 1320 F, because feeds above 0.031 ipr were not employed. At above feed and

CONSTANT-RATE MACHINING CURVES


FEED-IN. PER REV.
.004 .008 .012 .016 .020 .024 .028 .032
CARBIDE TOOLS
TOOL LIFE-CU. IN. PER .010" WEAR
0 5 10 15
MACHINING RATE 5 CU. IN./MIN.
6 CU. IN./MIN.
8 CU. IN./MIN.
RATE 5 CU. IN. PER. MIN.
1000 800 400 300 250 200 180 160 130
RATE 6 CU. IN. PER. MIN.
1200 700 500 400 300 250 200 180 160
RATE 8 CU. IN. PER. MIN.
1600 800 600 500 400 350 300 250
CUTTING SPEED-FT. PER. MIN.

FEED-IN. PER REV.
.004 .008 .012 .016 .020 .024 .028 .032
HSS TOOLS
TOOL LIFE-CU. IN. PER .015" WEAR
0 10 20 30 40 50
MACH. RATE 0.8 CU. IN./MIN.
0.9 CU. IN./MIN.
1.0 CU. IN./MIN.
1.2 CU. IN./MIN.
RATE 0.8 CU. IN./MIN.
70 60 50 40 35 30 25 20
RATE 0.9 CU. IN./MIN.
80 70 60 50 40 35 30 25 22.5
RATE 1.0 CU. IN./MIN.
90 80 70 60 50 40 35 30 25
RATE 1.2 CU. IN./MIN.
100 80 70 60 50 40 35 30
CUTTING SPEED-FT. PER. MIN.

Carbide Tools—Machining Rate

CU IN. PER MIN.	5	6	8
Feed	0.020	0.020	0.025
Cutting speed	210	250	265
Tool Life:			
Cu in. for			
0.010-in. wear	17	11.5	5
0.032-in. wear	102	69	30
Min. for			
0.032-in. wear	20	12	4

HSS Tools—Machining Rate

CU IN. PER MIN.	0.8	0.9	1.0	1.2
Feed	0.015	0.017	0.020	0.026
Cutting speed	44	44	42	38
Tool Life:				
Cu in. for				
0.015-in. wear	48	46	37	21
0.032-in. wear	192	184	148	84
Min. for				
0.032-in. wear	240	200	148	70

feed combinations, iron annealed at 600 F gave tool life of 32 cu in., and 1320 F-annealed stock gave 34 cu in. However, at 0.031 ipr and 135 fpm a very large increase in tool life occurred as result of heat treatment. The 600 F anneal produced tool life of 52 cu in. and the 1320 F anneal a tool life of 70 cu in. Thus, it is evident that as-cast nodular irons are more machinable than cast steel at heavier feeds and slower speeds, and that annealing greatly increases machinability of nodular irons. Possibly, a 900 F anneal is best.

Drilling of Cast and Nodular Irons

FOR THE purpose of improving drill life and reducing machining costs, Ford investigated the drilling of cast iron in respect to:

1. Quality of cast iron, including studies of material defects, such as segregations, sand and porosity.
2. Drilling speeds and feeds
3. Drill design
4. Drill material

Tests were conducted on cast iron with a machinability index of 1, an iron used for various automobile castings.

Summary of Results

1. Controlled foundry technique was found necessary in order to prevent premature drill failure caused by segregations of hard constituents. These segregations were created by foundry use of excessive amounts of inoculant that promoted formation of high-silicon ferritic iron, and by improper use of tellurium, used as a core wash and forming white iron in boss areas.

2. A double-point-angle HSS drill was found better than the conventional 118° grind. Conventional T-1 HSS drills proved satisfactory.

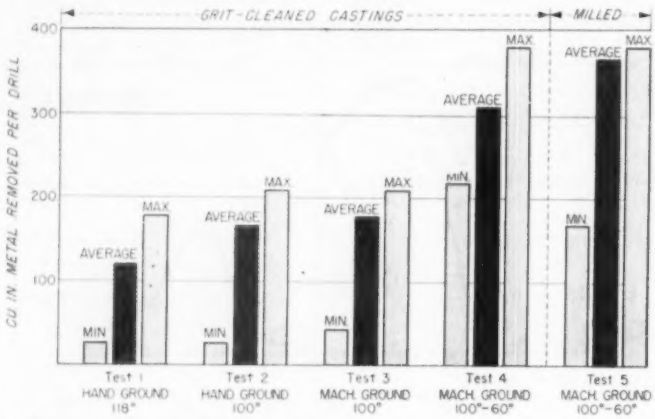
3. Milling the casting surface prior to drilling removed hard skin, minimized the effects of sand and porosity. Hence, the machining lines were rearranged to mill the castings before drilling.

4. Optimum cutting speed was found to be 85 sfpm at 0.007 ipr. For this reason, the multiple-spindle drilling machines were modified to produce these speeds and feeds (they had been operating at 700 sfpm and 0.008 ipr).

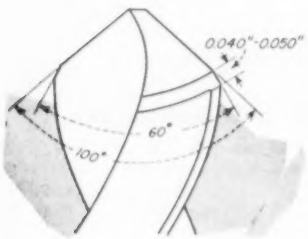
5. Drill replacement after 16 hr production was adopted as the optimum schedule in order to minimize work stoppages.

These conclusions were reached by statistical analysis of tests carried out by the Research Department and cross-checked in production. Drills used were 1/2 in., the hole 3/4 to 7/8 in. deep. It was found that a standard wear land of 0.020 in. on the cutting edges should not be exceeded in order to avoid breakdown on the OD and rough holes.

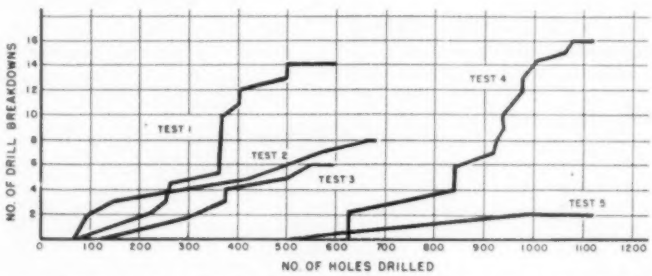
HSS drills were used on unmachined and machined test pieces at 70, 85 and 110 sfpm, and a feed of 0.007 ipr in all cases. For nonmachined plates, volume of metal removed at 0.006-in. wear land averaged 244 cu in. at 70 sfpm, and 99 cu in. at 100 sfpm. For ma-



Each improvement in drill grinding produced a gain in volume of metal removed. Sixteen drills were used for each test. Minimum performance represents the poorest drill, average performance the average volume of chips for the set



Drill life is greatly increased by using a double-angle grind—100° for the point angle and chamfering the lips 0.04-0.05 in. by 60°



To minimize work stoppages, drill failures were plotted against holes drilled. Test 5 shows that at 800 holes, or 16 hr production, the chance of work stoppages is slight, when castings are milled to remove skin and surface segregations, and the drill is the 100°-60° machine-ground type

chined plates, the volume removed was 485 cu in. at both 70 and 80 sfpm and 450 cu in. at 110 sfpm. A speed of 85 sfpm was selected as best considering tool wear and breakage.

The type of grind and the regrinding schedule were obtained by five tests, all run at 85 sfpm and 0.007 ipr. Three of these tests were run for 16-hr periods, the last two for 28-hr periods. Drill failures were:

Test 1—118° hand ground. First failure at 75 holes, four failures at 300 holes, 14 failures at 600 holes.

Test 2—100° hand ground. First failure at 75 holes, four failures at 300 holes, eight at 660 holes.

Test 3—100° machine ground. First failure at 125 holes, two failures at 300 holes, and six failures at 600 holes.

Test 4 — 100°-60° machine ground. Non-machined castings. First failure at 630 holes, three failures at 800 holes, 16 failures at 1110 holes.

Test 5 — 100°-60° machine ground. Milled castings. The first failure occured at 500 holes, the second failure at 1000 holes.

Nodular Cast Iron

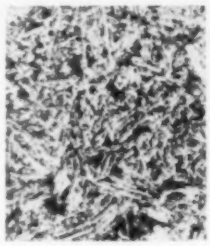
Annealed nodular cast iron is easier to drill than cast steel. Less chatter and drill breakage occurs in drilling deep holes. The chip is not powdery like cast-iron chips and does not pack in drill flutes. Coolant reduces drilling torque. Tests were carried out with a 1/4-in. drill running at 800 rpm and fed at 0.005 ipr to depths of 3 in.

Carbide Drilling

Ford has put into service two automatic drilling and tapping machines to drill, ream, bore, spotface and tap cast-iron water pump bodies. All tools except the chrome-plated HSS taps are carbide. Drills operate at 138 to 260 fpm at feeds of 0.006 to 0.007 ipr, reaming is done at speeds between 86 and 318 fpm. Drills vary in diameter from 1/4 to 9/16 in. The machine is considered the first all-carbide-drill equipped machine used for mass-production purposes. Pump bodies are annealed, then machined at a rate of 435 pcs per hr at a cycle time of 6.2 sec.

RELATIVE MACHINABILITY OF SAE 8640 STEEL

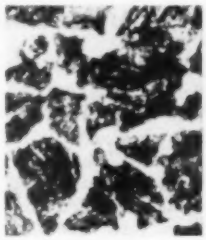
IN DESCENDING ORDER FOR VARIOUS STRUCTURES



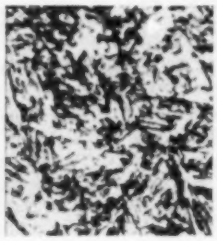
1. Widmanstatten, annealed 255 Bhn. 100X

2. Spheroidite 160 Bhn. 2000X

3. Tempered Martensite 219 Bhn. 1000X



4. 75% Pearlite — 25% Ferrite, Annealed 215 Bhn. 100X



5. Tempered Martensite 302 Bhn. 1000X

6. Tempered Martensite 400 Bhn. 1000X

BEST TOOL LIFE with hard carbides is obtained with the widmanstatten structure, although it is considerably harder than the spheroidized material. Optimum cutting conditions for a steel are therefore based on the structure and the tool material, in addition to feed and speed.

How Microconstituents Affect Machinability of Wrought Steels

STEELS AND CAST IRONS have many common microconstituents, including ferrite, pearlite and free carbide (page 111). Free ferrite is present in most low-carbon steels (85% in SAE 1010) and in medium-carbon steels of 0.35 to 0.50% C, if slowly cooled (SAE 1040—50% free ferrite, 50% pearlite).

Pearlite is present in small quantities in low-carbon steels, and the amount increases with carbon content. Thus, SAE 1010 contains about 15% pearlite, SAE 1040, slowly cooled, about 50%, and SAE 1080, slowly cooled, about 100%. In medium-carbon steels like 8640 it is possible to obtain almost 100% pearlite by the proper cooling rate from the austenitic temperature range, but the lamellar spacing is extremely fine.

Free carbides occur in steel as minor constituents, and appear as white areas with definite grain boundaries. In ordinary steels, presence of free carbides usually indicates lack of control in heat treatment. In high-carbon and tool steels, free carbides are usually present, but must be uniformly distributed.

Other microconstituents of steels that require attention are:

Spheroidite—In annealed steels, combined carbon is generally in the form of iron carbide as a constituent of pearlite. The platelike form of the carbide may be altered to spherical shape by a variety of heat treatments. Spheroidized steels generally provide longer tool life when machined with HSS tools, but have no particular advantage over other annealed steels when machined with carbides.

Widmanstatten structure—When steels are cooled at a critical rate

from extremely high temperatures, as in forging or rolling, the ferrite-pearlite structure has a characteristic cross-hatched appearance. When using KH3 or 78 carbides, up to three times the tool life was obtained when machining the widmanstatten structures, as for conventionally annealed or normalized structures.

Martensite — This hard, brittle constituent is formed when steel is quenched or cooled very rapidly from the austenitic temperature and is characterized by a needle-like or acicular appearance. As-quenched constructional steels are seldom used in that condition, but are tempered to 250 to 400 Bhn to improve physical properties: tool steels to 60-65 Rockwell C.

Bainite — A feathery combination of ferrite and carbide occurs in steels treated isothermally in the 480-1100 F range.

Manganese sulfide — Slate-gray non-metallic inclusions, usually appearing as elongated stringers in rolled materials, are present in traces. Manganese sulfide apparently smears over the tool face and reduces friction between chip and tool.

For purposes of machinability, steels can be divided into:

1. **Low-carbon stock containing about 0.10% carbon.** The free-machining variety contains about 0.1 to 0.35% sulfur. Other than adding sulfur or lead, little can be done to improve machinability of such steels.

2. **Carburizing steels usually contain 0.20% carbon, have a structure consisting of 70% ferrite, 30% pearlite.** Grain size may be large or small, depending on heat-treatment. If ferrite and pearlite are banded, machinability is adversely affected. Furnace annealing fails to maintain adequate control of microstructure and desirable large grain size. Salt-bath annealing affords uniform distribution of ferrite and pearlite and a definite grain size.

3. **Medium-carbon steels are capable of assuming a wide variety of structures** (see photomicrographs of 8640 steel), or combinations thereof. For example, a bar may exhibit coarse pearlite on the outside where the cooling was rapid and spheroidized carbides on the inside. Large variations in structure are also possible from bar to bar in the same heat of steel, and the hardness will likewise vary. Machinability varies greatly under such conditions. Hence, one must know what to expect at the area to be machined, and what treatments may be used to improve tool life and the hourly output of machine tools.

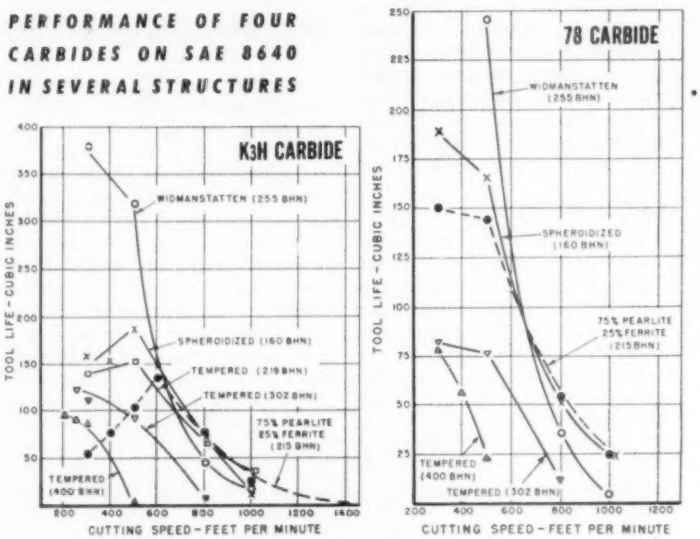
In production machining it is vitally important to maintain consistent microstructure (by appropriate heat-treatments) because slight deviations can be responsible for great variations in tool life. **It is believed that once the microstructure of any piece of steel has been determined, the tool life and cutting speed relationship become fixed, almost regardless of the composition of the steel.** Test results that follow were made with a 2-component dynamometer.

Steel Microstructure Affects Carbide Selections

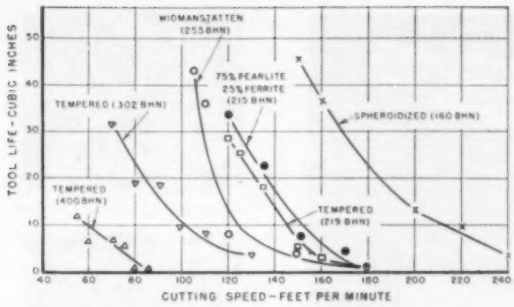
SLIGHT DEVIATIONS in microstructure have a profound effect on tool life and carbide selection. Tests were made on five structures of SAE 8640, a medium-carbon steel used throughout the automotive and aircraft industries. This steel was machined in three annealed states—75% pearlite with 25% ferrite, widmanstatten and spheroidite. Hardnesses were 215, 255 and 160 Bhn, respectively. The softest structure, spheroidite, gave best tool life with HSS, whereas the widmanstatten structure gave up to three times the tool life of the conventional annealed structures, when the harder grades of carbides were used. The same steel with tempered martensitic structures in hardnesses of 219 and 302 Bhn showed lower tool life.

Tests with carbide tools were made at 0.100 in. depth of cut and 0.010 in. feed at cutting speeds from 1500 down to 200 fpm, and were ended when the wear land reached 0.015 in. Type AR-8 lathe tools were used. Specifications were: 0°BR, 6°SR, 0°SCEA, 6°ECEA, 6° side relief, 6° end relief, and 0.020 in. nose radius.

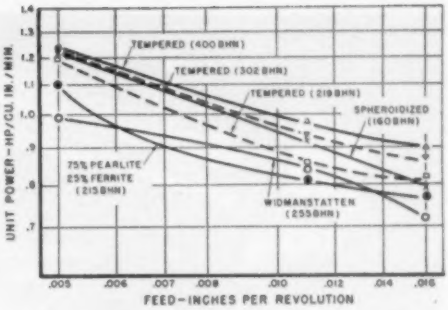
PERFORMANCE OF FOUR CARBIDES ON SAE 8640 IN SEVERAL STRUCTURES



Hard carbides K3H and 78 have tool life of about the same order or magnitude on five structures tested, with K3H somewhat better on annealed steels and 78 slightly superior on tempered structures



High-speed steels have tool life decreasing with structure hardness. Spheroidized steel has seven times tool life of annealed pearlite at 160 fpm



Power required in carbide turning will decrease with feed increase, but is proportional to structure hardness except for spheroidite

HSS tools were operated at the same depth of cut and feed until the nose radius broke down completely. The grind was: 0°BR, 15°SR, 0°SCEA, 5° side relief, 5° end relief and 0.015 in. nose radius.

Tool life obtained in machining the various structures depended upon the type of carbide used. For quenched and tempered structures, tool life increased as the material's hardness decreased. But there was little relationship between hardness and tool life of the three annealed structures. The hard carbide, K3H, had the longest tool life on the widmanstatten structure, about twice that for any other structure when used in the 300- to 600-fpm range. But all of the annealed structures showed a break in the tool life-cutting speed curve in the vicinity of 500 to 600 fpm. It is advisable to pick an appropriate speed within this range, when cutting annealed steels with hard carbide.

When general-purpose carbides like KM and 78B were used, the relative tool life on annealed structures showed significant changes. For KM, the spheroidized structures generally gave the superior performance, while widmanstatten dropped to second best, and pearlite was a poor third. On the other hand, with 78B the pearlite was best at speeds up to 600 fpm and widmanstatten dropped to fourth place.

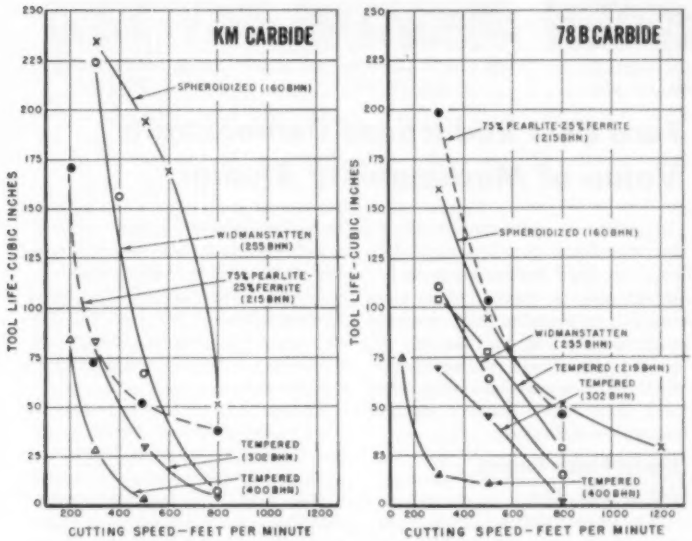
These tests showed that the hard carbides must be used at high cutting speeds in order to take proper advantage of their properties. At speeds over 500 fpm, K3H and 78 provide double the tool life of general-purpose grades like KM and 78B. But when speeds of around 250 fpm must be used for some reason, for example to resist shock loads in rough turning, the reverse is true. Therefore if the job requires slow speeds, do not use the hard carbides.

Previous shop experience was borne out when the several structures were machined with HSS except in case of spheroidite.

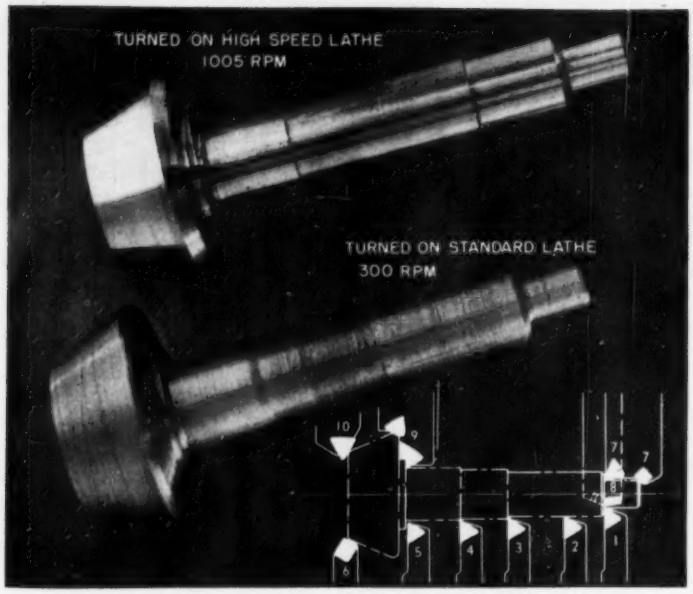
If finish is important in the turned structure, it will probably be advisable to consider the machining of the quenched and tempered (martensitic) steels. Profilometer readings on tempered steel ranged between 90 and 100 Rms, and for annealed structures between 130 and 150 micro-inches.

Power required for turning various 8640 structures decreases with increase in feed. For a given feed, power is proportional to hardness, with one exception. The spheroidized structure, although of lowest hardness (160 Bhn), required as much power as a martensitic structure of 300 Bhn over much of the range of feeds used.

Although the tests demonstrate that annealed structures have cer-

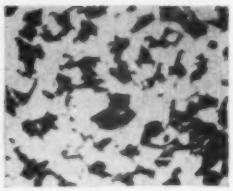


General-purpose carbides KM and 78B should be used at slower speeds to attain high tool life. Spheroidized structure machines best with KM, the pearlite with 78B. No cutting fluid was used in all tests

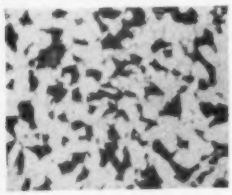


BETTER FINISH ELIMINATES OPERATION

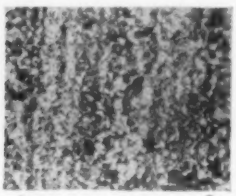
Second operation on Ford pinion was eliminated by surface-finish improvement resulting from high-speed turning of 4028 with suitable microstructure



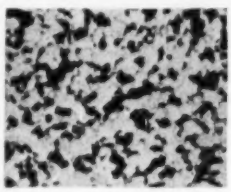
4028 Single salt-bath. 149 Bhn



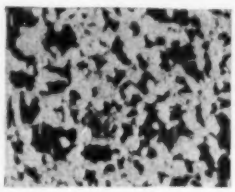
4028 Double salt-bath. 163 Bhn



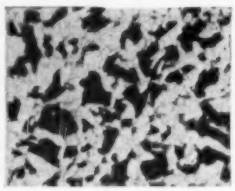
4028 Shank end of pinion



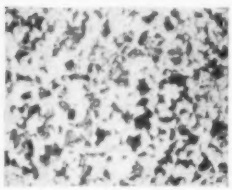
8620 Normalized. 163 Bhn



8620 Double salt-bath annealed. 103 Bhn



8620 Single salt-bath annealed. 159 Bhn



8620 Shank end of pinion. Never austenitized

tain machining advantages with carbides, attempts to specify an annealing cycle that would give the structure sought were largely unsuccessful. Instead, it was found necessary to experiment with annealing procedures and obtain the desired structure by trial and error. Many inconsistencies inherent in a continuous process can be minimized by cycle annealing, wherein important transformations in the steel take place at constant temperature. By this process, as in salt-bath methods, parts are rapidly cooled or quenched to a predetermined temperature and held there until the transformation is complete. Then, further cooling has no effect on the structure within specified limits of uniformity in minimum time.

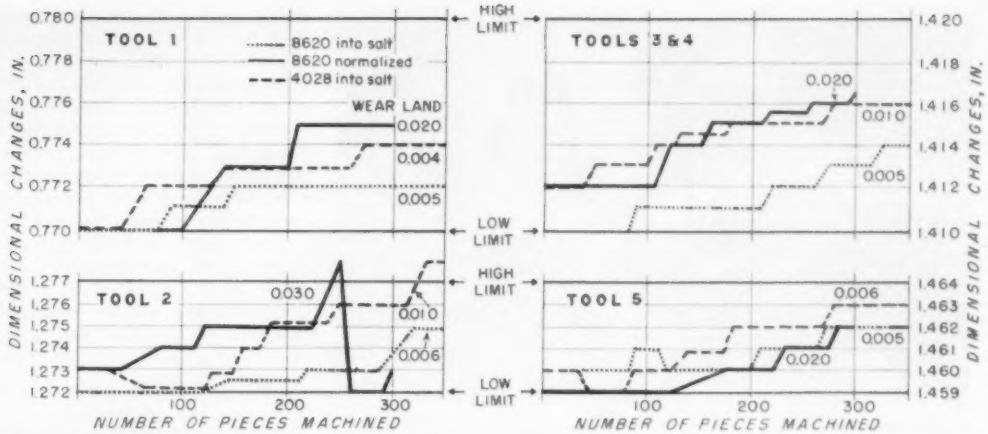
Ford Cost Reductions Demonstrate Value of Machinability Studies

To ARRIVE at optimum conditions for machining barstock and forgings, the Ford Motor Company has investigated a number of parts in relation to metallurgical, machine tool, cutting tool, and coolant requirements. Steels studied include SAE 8620, resulfurized 4028, 5132 and 5240. Work done on several parts is summarized.

Hypoid-Pinion Forging Cut at 825 Fpm

The hypoid pinion for the differential is an upset forging. This part is now produced from SAE 4028 with a carefully controlled blocky-type structure and a grain size of 4 to 6. Machining cost of the pinion has been reduced approximately 65%. Such savings could not have been possible without a metallurgical study to obtain maximum life of carbide tools operating at high cutting speed.

Formerly, the green (unhardened) pinion was produced on 17 machine tools. Eleven of these were prewar multiple-spindle lathes tooled with HSS, and three more machines were required to take a qualifying cut before generating the teeth. Now, a centering and facing machine prepares the forg-



For quality control and maximum tool life, the wear of carbide-insert tools was plotted in relation to pieces produced and dimensional changes of the part. Maximum permissible tool wear is 0.030 in. Tool 6 (opposite page) is critical one, gives 350 pcs per grind on 4028 annealed at 1190 F. Such studies minimize rejected parts between grinds

ings for two single-spindle automatic lathes. Operating at a spindle speed of 1005 rpm and a feed of 0.0148 in., these lathes have one critical tool operating at an average cutting speed of 825 fpm, but all tolerances are held for 300 pcs. Actual cutting time is 12.5 sec, and floor-to-floor time is 23 sec. The new installation saves 48% of the floorspace formerly required.

Machine design for this pinion-turning job is the result of close cooperation between Ford and the machine-tool builder in respect to exchanging ideas on both high-speed machining and avoidance of work stoppages and breakdowns in high production.

Ford's interest in the pinion job was related primarily to machine and cutting-tool serviceability at comtemplated feeds and speeds, and the quality of the machined parts relative to dimensional tolerances on a production run. No. 6 of the solid-carbide tool inserts was seen to be the critical tool since it would operate at an average cutting speed of 825 fpm, while tool No. 1 would operate at only 190 fpm.

Machinability studies were carried out on SAE 8620 and resulfurized 4028. Several pre-machining heat-treatments were investigated with respect to potential tool-life improvement.

In forging the pinion, the gear portion is induction heated to 2150-2250 F and upset. Heating raises the localized area above the austenitizing temperature, but not the shank end. Hence, the piece must be given an annealing treatment to restore the upset portion to a machinable condition.

Relative advantages of three heat treatments were evaluated by tool life tests at the selected spindle speed. These tests were:

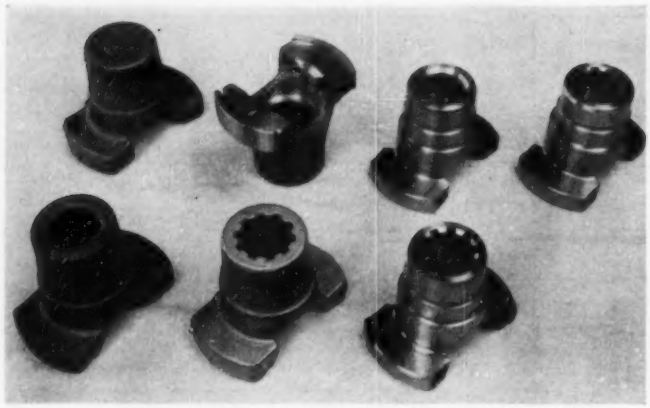
Air-furnace normalize—Heat to 1775 F in 1½ hr, hold at temperature for 2 hr to assure complete transformation to austenite and to promote grain growth. Furnace cool to 900 F in 4 hr for slow transformation, then air cool. Resultant structure is about 75% ferrite and 25% pearlite of uniform grain size and some banding.

Double salt-bath anneal—Transfer to salt bath at 1650 F immediately after upsetting, hold 8 to 10 min. to raise the formerly unheated shank to above the transformation range, transfer to 1190 F salt bath for 45 min. for structure transformation, water dip, air cool. The structure is a combination of ferrite and pearlite with grains at the gear end somewhat coarser than for normalized steels. At the shank end, the grain was finer and there is some evidence of banding.

Single salt-bath anneal—Transfer forging immediately from upsetter to 1190 F salt bath, hold for 45 min. to effect transformation, water dip to free salt, and air cool. At the gear end of the pinion, the structure is like the normalized structure but slightly coarser from its higher temperature of formation. At the shank end, the steel was never heated above the transformation range in either forging or annealing, and hence exhibits the "as-rolled" pattern, which varies according to rolling-mill practice.

In a process where forging can be immediately immersed in the single salt-bath anneal, considerable manufacturing economies can be obtained. The parts supply some of the heat required for the annealing cycle, less power is required, mechanization is simpler, and annealing fixtures have longer life at the lower temperature. Since tool life is not critical on the shank end of the pinion, it is expedient to use the single salt-bath anneal instead of the double treatment, to save hours of heat-treatment time and handlings.

Tool life data on all cutting tools indicated that salt-bath annealed forgings machined better than normalized stock in both steels. Wear lands on tools 1, 2, 3, and 4 varied from 0.006 to 0.010 in. for annealed stock as compared to



Machining-time reduction amounts to 70%, floorspace savings to 80% with proposed method of manufacturing Ford rear-axle flange coupling. Previous method (upper row): Solid forging—drill and face one end, turn and face other end, broach internal spline. Proposed method (lower row): upset tubing—broach internal spline and turn all over

0.020 to 0.030 in. when machining normalized steel.

Surface finish is improved by high-speed machining. In the previous setup, the surface finish secured on the pinion ranged from 570 to 340 micro-inches Rms, while on salt-bath annealed forgings, the Profilometer readings range from 260 to 200 micro-inches, depending on the diameter. Finish improves with speed.

The advantages of salt-bath-annealed stock carry through into operations after turning of gear blanks. Less burning of hobs and cutters and less drag occur and a better gear face is produced as compared with normalized steel. Sound testing has shown 20% fewer rejects for eccentric hop (distortion in the hardening heat-treatment). Therefore, fewer gears must be relapped. And for relapped gears, one pass normally suffices to correct the bearing against several for previous steel.

SAE 5132 and 5140 Steels

As part of a broad study of the reprocessing of another Ford part, lathe tests on 5132 and 5140 steels were conducted in the laboratory and then checked on production equipment. Barstock was tested in two forms: Quenched and drawn to a well-tempered martensitic structure (255-302 Bhn) and salt-bath annealed to a pearlite-ferrite structure (174-201 Bhn).

In these tests, K3H carbide tools (square clamped insert) were ground as follows: Br 7° neg., SR 7° neg., SCEA 15°, ECEA 15°, side and relief 7°. Depth of cut was 0.062 in., feed 0.010 ipr and cutting speed 300 fpm. Coolant: 40 to 1.

When curves were plotted for cutting speed *vs* tool life, it was found that both plots peaked at 200 fpm for 0.010 ipr. And when tool life was plotted as a function of feed rate, it was found that the curve for quenched and tempered steel peaked at 0.017 ipr, and the curve for annealed steel at 0.025 ipr, (both tests made at 300 fpm.) Since the loss in tool life by machining at 300 fpm amounted to only 10% for a 50% increase in rate, the higher speed was adopted.

Ford practice on forgings is normally to employ a depth of cut of 0.100 in. By calculation, it was found that the relative machining efficiencies of quenched and drawn steel *vs* annealed steel could be summarized thus:

	Quenched and drawn	Annealed
Cutting speed	300 fpm	300 fpm
Depth of cut	0.100 in.	0.100 in.
Metal removal	6.1 cu in. / min.	9.0 cu in. / min.
Machining time	0.24 min	0.16 min.
Hp at tool	5⅛	7¾
Volume metal 0.030 in. tool wear	400 cu in.	800 cu. in.
Number parts 0.030 in. tool wear	300	600

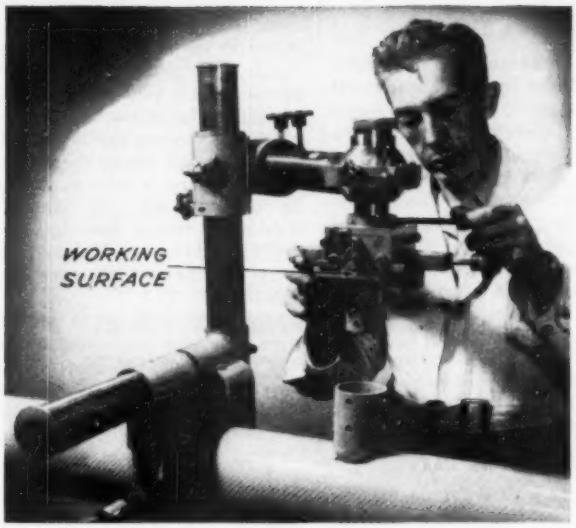
When actual parts made of 5140 were machined on production equipment, and wear on the critical tool was measured, it was found that approximately 25% less tool life could be expected than under ideal laboratory conditions.

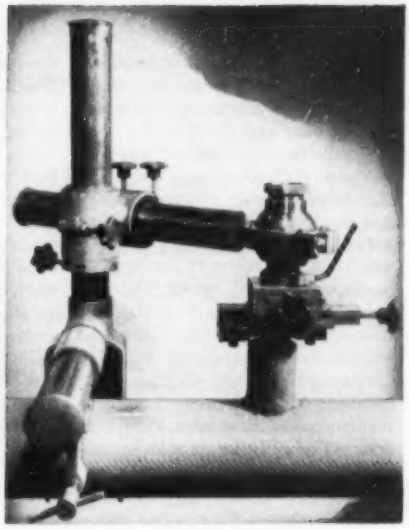
Machinability Data Stimulate Progress

WITH MACHINABILITY DATA at their fingertips, Ford manufacturing engineers are reaching out in a number of directions to cut costs. A proposal for the rear-axle flange coupling is a case in point. This part has long been made from a forging. Drilling out considerable metal for the internal spline constitutes a slow, costly operation. And turning is done with multiple-spindle lathes tooled with HSS.

With data available on carbide turning, the entire problem of making this part was reviewed. It was found that a stronger, better forging could be upset from tubing, and the hole held concentric with the OD within 0.020 in. So, under the proposed method, the piece would be broached first, then turned on a new high-speed, 8-spindle, double-indexing chucker equipped with carbide tooling. Contemplated maximum cutting speed is 1000 fpm at a feed of 0.12 to 0.015 in. Eight old machines would be replaced by one chucker. And it is likely that burnishing of the oil seal on the part can be handled in the chucker, saving a grinding operation and producing a better micro-inch finish.

When the engineer knows optimum machining rates, he is free to work out the matters of tool design like a chuck to obtain desired concentricity and chip breakers on carbide tools. In one step he moves toward ultimate performance rather than cautiously applying carbides and hoping for the best.





Universal positioning tool speeds attachment of finished working surfaces to basic structure of aircraft fixtures. Tool is clamped to structure adjacent to where working point is to be established and working surface is clamped to its setting face. Tool then is adjusted in any direction until surface is level and to correct dimension as determined by transit and level. When in final position, shank on working surface is within cylindrical cup. Cerro-alloy is poured into cup to anchor working surface in position. Method will save 36% of time of old method

American Machinist

UNIVERSAL LOCATOR SETS UP AIRCRAFT FIXTURES

Total fixture setup time cut 20% by improved method for attaching finished working surfaces to the basic fixture. Eliminated on a typical locator are 12 operations, 4 major components, and all doweling and bolting

BY LEON E. LAUX, Group Engineer, Design Section, Tool Engineering Department
THE GLENN L. MARTIN COMPANY, BALTIMORE, MD.

FINISHED working surfaces can now be established on the largest aircraft fixtures at a fraction of the previous cost. This is made possible by a new method of attaching loose finished surfaces to the rough basic structure of conventional steel-pipe assembly fixtures.

Developed at The Glenn L. Martin Company, the new method features a small portable positioning tool that is well adapted to quick and accurate positioning of the working surface. After the conventional assembly fixture is set up, a cylindrical cup is welded to the fixture in an approximate, predetermined location. The positioning tool, supporting the working surface, then is moved into place and is manipulated to locate the working surface accurately over the cup. A low-melting point Cerro-alloy next is poured into the cup where it solidifies to hold the surface firmly in the desired plane.

The new method is for fixtures that are too large for machining on available planers or for those on which there are too few working surfaces to warrant machining. It supersedes all previous methods of attachment and provides large savings in labor and material. For example, in attaching a single-

detail hinge locator 12 operations are eliminated and an estimated 1 2/3 hours in machining and positioning time are saved.

Before the new method was developed, six components were required to establish a hinge locator, five machining operations were involved, and the adjusting process was slow and costly. First, a support was welded to the basic structure. A second plate, containing four setscrews, or jacks, was placed on this base and was adjusted until the desired plane was reached. The top plate then was secured to the base with bolts and dowels. In addition, it was necessary to jig-bore the hinge locator to close tolerances and to fasten it on the top plate. Finally, a Cerro-alloy was poured between the two plates to provide a more rigid structure. A total of 4 1/2 hours was required for machining the components and for the operations involved in attaching and adjusting them until an acceptable surface was obtained on the fixture.

Cuts Machining Time 50%

In the new method, only two parts are required — doweling, jacking, and bolting are eliminated —machining time is only 50% of the former figure—and the total time to produce and attach one locator has been reduced 36%. At the same time, there is no danger of warping or distortion such as might occur with a bolted and doweled assembly. A cylindrical cup first is welded to the basic fixture. The position of the cup is determined with sufficient accuracy by scale measurements and no precision measuring instruments are required. The universal positioning tool then is clamped to the basic fixture and the work-locating surface is clamped to its setting face. Adjustments are made quickly and easily in any direction until the working surface is leveled in the desired position as determined with a transit. Cerro-alloy then is poured into the cup. The molten metal solidifies in about 3 minutes on an average installation, rigidly anchoring the locator to the basic fixture structure. The positioning tool then can be moved to the next locating point, where the same series of operations is performed.

The section of locating surface that is embedded in the Cerro-alloy contains eight drilled holes. Eight holes also are drilled in the cup. Thus, when the Cerro-alloy solidifies, the entire unit is much more rigid than otherwise would be the case. This is important as each unit must stand up under normal shop abuse and maintain the original dimensional accuracy established among the working surfaces.

Many Tests Were Run

To check the suitability of Cerro-alloy for the applications, extensive tests were run before the method was approved. Vibration tests proved that the metal would not distort due to vibrations resulting from riveting. Torsion, tension, side load, and impact tests also proved the metal satisfactory. Several different Cerro-alloys were employed in these tests. "Cerro-tru" was found to be most desirable, because it did not misalign the locator during or after solidifying. "Cerro-tru" melts and flows freely in boiling water.

Working surfaces can be attached in any position—upright, downward, horizontal, or angular. Surfaces in the upright position are the easiest to attach. The alloy is melted in a temperature-controlled pot and is transferred to the cup on the fixture with a ladle. Tape is wrapped around the cup to prevent leakage through the drilled holes.

The procedure differs in some cases, for surfaces that are attached in the downward position. In this case, the Cerro-alloy cup is inverted and a hole is provided at the upper edge of the cup through which the Cerro-alloy is poured. Putty is packed around the locator at the open end of the cup, sealing the alloy in the cup. Another method—reversing the cup and post and eliminating the need for putty—will be used wherever possible.

Locators also can be of several types. One type is pictured in the lead photographs, another type is shown in the drawings illustrating the difference between the old and new methods. Still other types also are employed.

Other Advantages

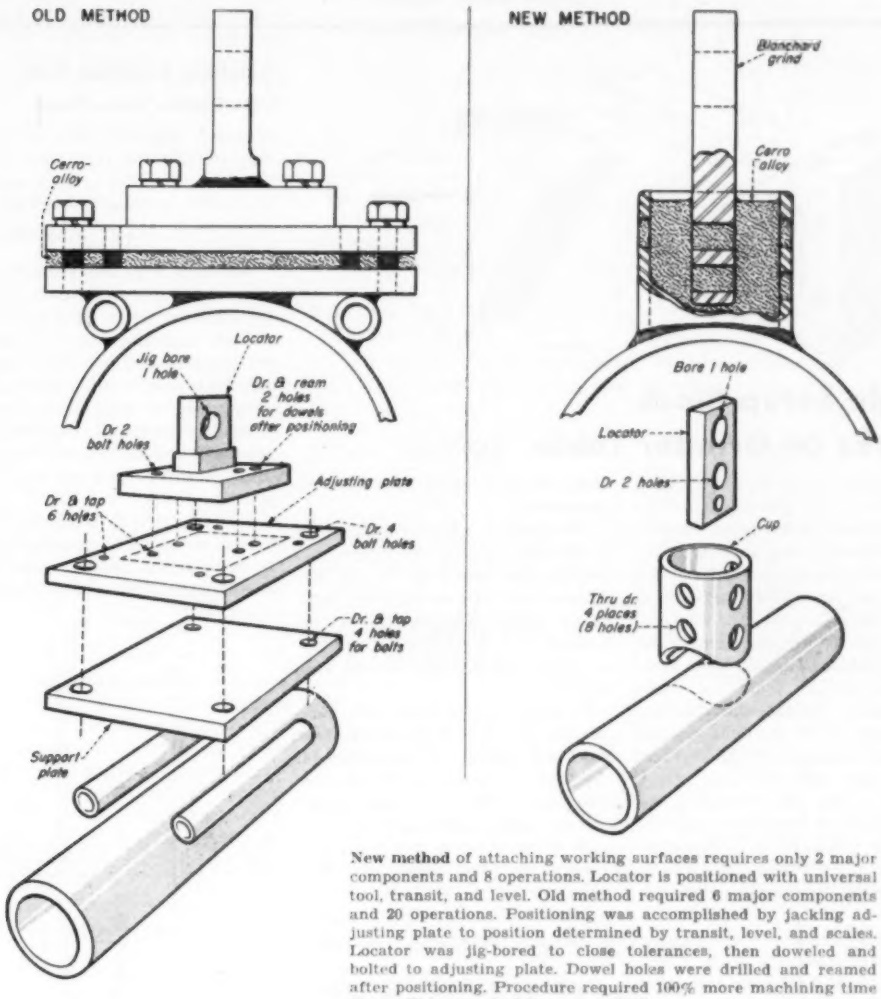
In addition to simplifying and speeding the attaching of working surfaces, the new method also has several other advantages. (1) Once set, locators are tamper-proof. (2) Locators can be produced at lower cost. Various parts of a locator can be standardized and stocked in sufficient quantities so costly, short-run setups can be avoided. (3) Cerro-alloy is salvageable and can be reused. (4) The positioning tool is light, portable, and compact. It overcomes practically all space obstacles and requires no additional space around fixtures when locators are rechecked or changed. (5) Once the tool is clamped to the setting face of the tool all readings for the position operation are taken directly from the locator and not through the positioner. (6) Existing instruments and equipment already employed in the plant, such as transit, level, and scales,

THE NEW METHOD WILL PRODUCE THESE RESULTS

	OLD METHOD	NEW METHOD	SAVING
Total Major Components	6	2	4
Total Minor Components: Dowels, screws, washers	14	0	14
Total Operations	20	8	12
Total Machine Time	2.5 hr	1.25 hr*	1.25 hr*
Total Time for Assembling, Attaching, and Positioning Working Surfaces	2.0 hr	1.66 hr*	0.34 hr*
Total Time per Working Surface	4.5 hr	2.91 hr*	1.59 hr*

*Estimated times. Further development may result in actual times that are lower.

NEW METHOD ELIMINATES 4 MAJOR COMPONENTS, SAVES 12 OPERATIONS



New method of attaching working surfaces requires only 2 major components and 8 operations. Locator is positioned with universal tool, transit, and level. Old method required 6 major components and 20 operations. Positioning was accomplished by jacking adjusting plate to position determined by transit, level, and scales. Locator was jig-bored to close tolerances, then doweled and bolted to adjusting plate. Dowel holes were drilled and reamed after positioning. Procedure required 100% more machining time than will be required in new method

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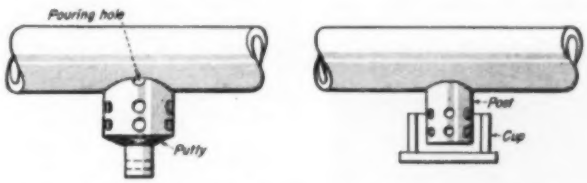
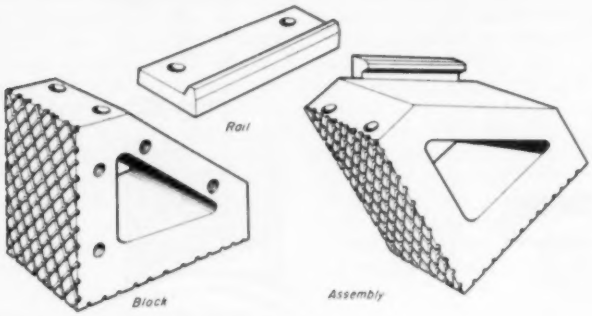
are used with the positioning tool. The tool itself is the only additional equipment needed.

It should be noted that the new method is in the process of evaluation at the present itme. Thus, all figures on time saved are estimates. It is expected, however, that further improvements will be made and the actual savings will be even greater than those given here.



Cup in downward position may be filled by either of two methods. At left, Cerro-alloy is poured through hole at top and is held in cup by putty seal. At right, cup and locator are reversed

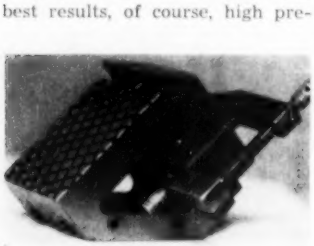
Practical Ideas



Angle Setup Block Works on Grinder Table

THIS ANGLE FIXTURE, made with two surfaces at right angles having a diamond-shaped pattern, has two advantages over angle plates or fixtures with flat surfaces. First, the pattern on the two surfaces helps reduce the effects of residual magnetism caused by electromagnetic grinder tables. This allows removing the fixture from the table much easier. Second, when the fixture must be slid over the grinder table, the channels in the surfaces collect dust and grit, and reduce scoring of the pads—keeping the flat surfaces in good shape. In addition to the regular surfaces, an accurate third surface is made at a 45° angle to simplify angle setups.

Materials required are a piece of cold-rolled steel, 2⅞ x 3⅝ x 3⅝, a piece of oil-hardening tool steel, 5/16 x 1 x 3, and two ¼-in. flathead screws. The base is drilled and contour-sawed out, then shaped or milled to form. For best results, of course, high precision in all forming operations is necessary.



The grooves that form the diamond-shaped pads are shaped by angling the block at 30° in the shaper vise; first to one side, then to the other. The tool should be ground to a semi-circular section to make the grooves smooth and regular.

To allow setups with work parallel to an edge of the block, two holes are drilled into two edges of the block so the rail can be screwed into place. The rail is shaped accurately and parallel, and is formed with a lip so work will not quite come to the edge of the block. The holes are drilled to allow the rail to be set up against the 45° angled surface and one of the grooved surfaces.

Careful heat-treatment is essential. The block was originally pack-hardened by heating to 1500 F for 4 hours, cooled to under 400 F, then repacked and reheated to 1450 F for 10 min and quenched in oil. Final surfacing was done by grinding lightly to provide a smooth finish and to insure that all right-angle surfaces were at 90°.

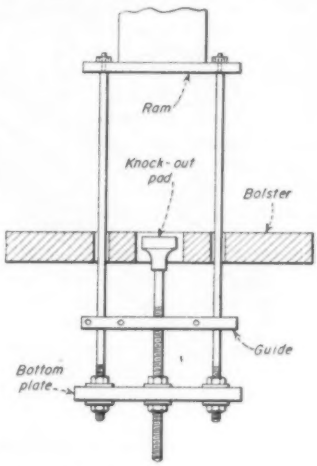
The block has been used for over two years, and due to the care in its manufacture, is still in perfect shape and appearance. *Charles Ashley and Jesse R. Lucas, Michigan City, Ind.*

Auxiliary Knockout Ram Lifts Blanks from Press

WHERE COMPRESSED AIR is not available to blow blanked parts from the press die, this simple rig can be added to the average punch press to do the job cheaply and surely.

We have a 24-ton press that is used for forming and slightly drawing some small hardware parts. We started the run with a spring knockout in position, but a slight burr on a part would often put the spring out of commission. It occurred to me that I could use the normally wasted power from the press as the ram raises to do the job.

A small ram is located in the bolster hole, and is supported from tie rods swung from the main ram of the press. To insure rigidity,



two brackets hold the rod of the ram to the longer rods. Two holes must be drilled through the bolster to admit these rods.

Depending on the punch-and-die arrangement, small additions can be made to the knockout ram to fit into the die, and some slight variations may be made in the main rods that hang from the main press ram. However, for a single-

acting power press that handles only small dies, the illustrated arrangement may work for all cases.

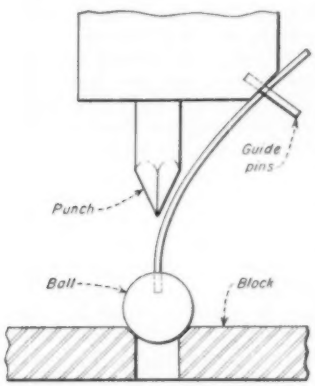
Even if the operator puts in two blanks by mistake, this device will eject both without difficulty. *R. R. Kadaba, Bombay, India.*

Kick-Press Punch Assembles Toy

IN MANUFACTURING a number of toys recently, we had to insert the ends of steel wires in small holes drilled in steel balls. On the experimental model, we threaded the wire and the hole to give us a good connection, but this sort of fabrication was obviously too expensive for the production run.

First we tried drilling a short hole in the ball, flattening the end of the wire slightly, and then clamping the wire in a vise and hammering the ball onto its end. The method proved practical as far as the joint was concerned, but it was slow.

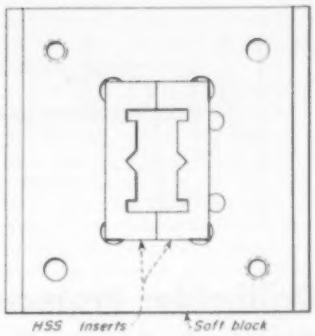
Our final method was to position the drilled ball on a drilled plate on a kick press. Two rods on the press ram guided the wire as it was positioned by hand, and a diamond-shaped punch was inserted in the press. After the wire was inserted in the hole, the press was kicked and the punch hit into the hole and wire. This raised a burr on both parts which made the junction effectively. *Bernard Levowich, Brookline, Mass.*

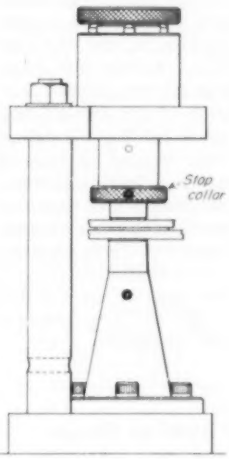


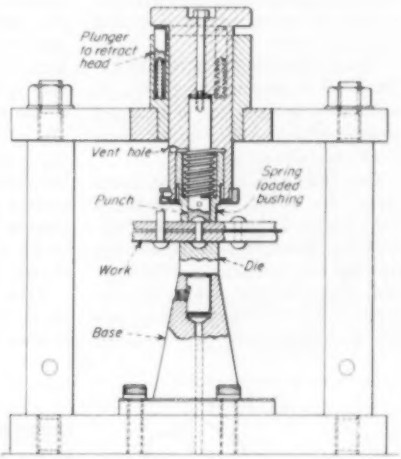
HSS Toolbits Make Inserts To Blank Abrasive Stock

IN MANY CASES where material being blanked in a press is quite abrasive, the following idea may help save the die edges, yet save money. High-speed-steel toolbits were templet-ground to the exact contour of a desired sheet-metal part —which, in this case, was symmetric—and the bits were inserted in a soft-steel die shoe. The inserts were fitted closely into the shoe, and were held in place by means of two tapered pins.

The additional cost of carbide dies was avoided in this case, and construction was simplified. Die life was extended, too. *H. M. Philbrick, Hartford, Conn.*





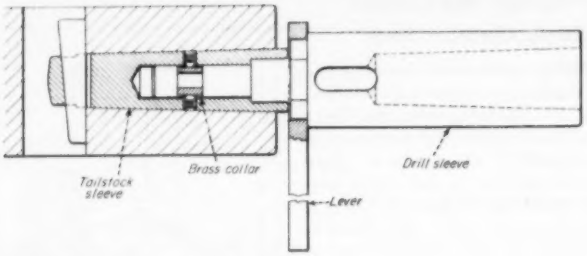


Rivet-Heading Fixture Works in Any Press

DESIGNED FOR pressure-heading rivets that hold blades between the hub spiders of cooling fans, this fixture can readily be adapted for many other riveting jobs. It is a self-contained unit that requires no additional setting once it is aligned and located under the ram of a press.

Different components and rivets can be headed by changing over to other punch-and-die sets. Unusually large clearance is provided so parts of bulky and uneven shape can be handled without interfering with the heading operation. For the original job, the clearance allower insertion of the fan blades between the supports of the fixture.

A spring-loaded bushing is installed to compress the parts together to insure alignment before the rivet is headed. For best results, the upper die, or punch, which heads the end of the rivet should be highly polished. *R. B. Wolverhampton, Staffordshire, England.*



Drillholder Protects Tailstock-Center Taper

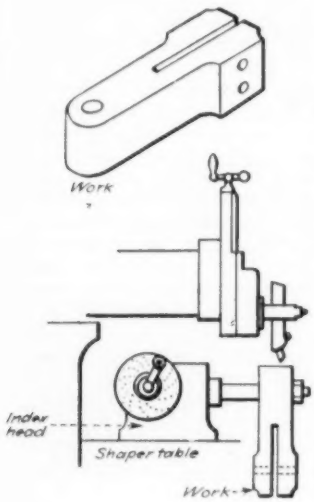
AFTER OUR COMPANY received three new lathes, the superintendent looked them over and pronounced them fine equipment. However, he called me in the office and laid down the law:

"No drilling and no reaming—I'm tired of having the tapers on our lathes banged up and scored because of the careless use of badly fitted sleeves and drills."

This handicap had to be overcome. An engine or toolmaker's lathe without the use of the tailstock for drilling would not do. The solution was to make a drillholder with a handle and a precison tapered end to fit the tailstock center. A tapered bore was provided so the reamers could be gripped.

A long sleeve with a Morse taper to fit the drills was mounted inside a second sleeve that fitted the tailstock center. The second sleeve was held in the tailstock with a gib key. A lever with a hex hole in its shank was pressed onto a hex section of the drill-holding sleeve to allow holding or rotating the drill when desired. A neck in the drill-holding sleeve was fitted with a split brass collar that was held by setscrews through the wall of the rear sleeve—this to keep the holder in the tailstock.

After two years of use, the device has proved its value. *Antonio R. Raszl, Rio de Janiero, Brazil.*



Indexing Head on Shaper Helps Cut Radius

WHEN THE LOWER ARM of one of our punch presses broke we were really in a spot, because the manufacturer had gone out of business. We had to make a new part ourselves. We started off by casting the piece.

The work was simple until we came to the bottom radius, which rode in the ram and delivered all the pressure. The hole is for a pin that brought the ram back up after a stroke.

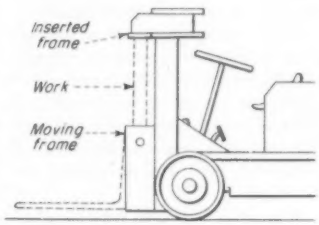
Using an indexing head on a shaper, we cut the radius and managed to get a fine finish and close tolerance. This method worked well, and as proof, the press is still running. *Bernard Levowich, Brookline, Mass.*

Fork Truck Provides Emergency Hydraulic Power

FOR A SHORT PRESS JOB requiring a longer stroke than we had on our regular press, we converted a hydraulic lift truck into a press.

A frame was welded up and inserted in a suitable recess in the vertical post of the truck to act as an upper platen. The original moving fork and assembly was used as the ram of the press, which meant that the die was above the punch.

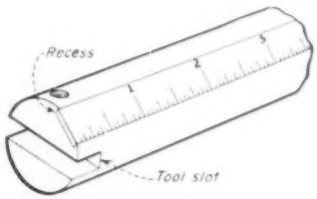
A force of 5 tons and a stroke of 30 in. was thus provided. *Haim Murro, Jerusalem, Isreal.*

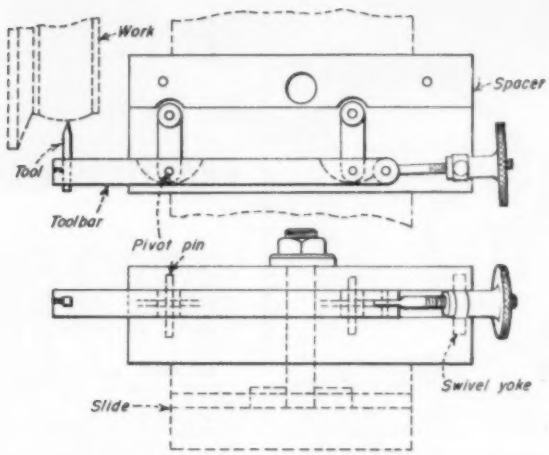


Boring Scale Feeds Along With Toolbit

FOR A ROUGH indication of how deep a boring bar has been fed into a hole, a standard steel scale can be attached to the bar as shown. The regular boring bar was slotted to take the scale. The slot was made a fairly tight fit for the scale, but was not too tight. To allow for adjustments after the boring bar was in place inside the work, the scale could be shifted if necessary.

The end of the boring bar was heat-treated, and the scale was hardened, too, to resist wear from chips that are shoved past it. *Edward Swamer, Appleton, Wis.*





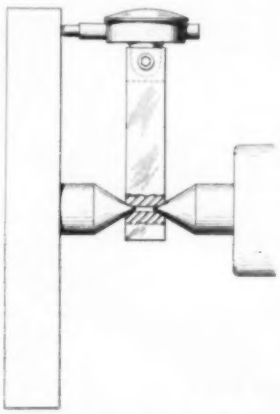
Radius Turner Cuts Edges of Large Parts

A PRODUCTION RUN of large-diameter work had to be turned to a radius on the edges. The illustrated tool was made economically and did the job well.

The tool was mounted on the compound rest of the lathe. An assembly was made with a top plate, bottom plate, and spacer plate, all bolted together. Two swivel links, pinned between the top and bottom plates, were anchored to the tool bar with pins. The links had equal radii, so the toolbar was always parallel to the axis of the fixture.

The outboard end of the toolbar —near the chuck—was fitted with a single-point tool ground to a sharp edge. The rear end of the toolbar was pinned to a third link which connected to a small handwheel held in a yoke. The toolbar was advanced or withdrawn by turning the handwheel, which made the end of the toolbit follow a radius path. During setup, this path had to be centered on the work.

The same kind of rig can be utilized for many edge-turning jobs where smooth curves must be formed. By lengthening the two swivel links, the radius turned is made larger, and vice versa. In fact, the radius of the circle turned is exactly that of the length of the links, between pins. *Ralph S. Cowley, Seward, Nebr.*

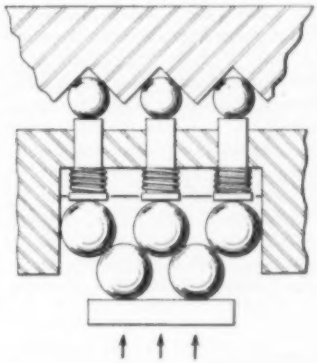


Faceplate Gage Indicates Lathe Runout

FOR CHECKING to see if a faceplate has runout in relation to the tailstock center, or vice versa, this simple gage can be made quickly and set up easily. The indicator will not only tell the direction of the runout, but will also indicate how much there is.

A square piece of cold-rolled steel is centered on both sides near the bottom. This is best done, for accuracy, by centering one side, drilling a small hole through, and then centering the other side. A dial indicator is attached at the upper end of the bar. It is important to make sure the centering cuts are accurate.

A tailstock center and spindle-nose center are mounted, and the device is centered between them. Revolving the faceplate slowly shows up runout, especially if the indicator is set to zero before the rotation is started. *Irving Monsfield, New York, N. Y.*

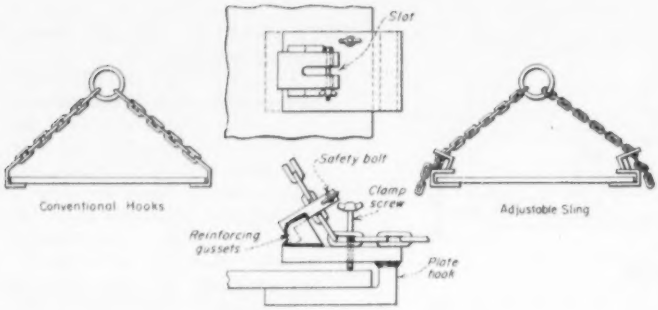


Equalizing Mill Jaws Grip Multiple Work

TO HOLD a number of rod, bar, or round parts in a miller fixture, this equalizing arrangement was made. The same principle can be utilized when some of the parts are not the same size, within reasonable limits.

Force applied to the balls will shift them around so they will apply force to the plungers. Because the plungers are held in a drilled movable jaw, pressure against the work will be equal and exactly parallel to the motion of the vise.

The plungers are spring-loaded to release the work instantly as soon as the movable jaw is backed off. *F. A. Adams, Dayton, Ohio.*

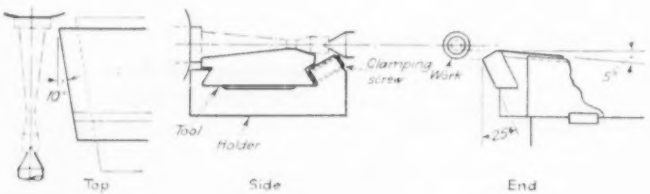


Adjustable Plate Hooks Simplify Sling Handling

WHEN LIFTING plates under low overhead we found that one sling will not very well accommodate all plate sizes. When the chain lengths are fixed, as with the sling at left, a short plate cannot be lifted as high as a wider one. Therefore, a sling with adjustable chain lengths is a logical improvement, as long as it can be done safely. This one is almost foolproof.

The adjustable sling is made by welding up two plate hooks—which fit over the end of the plate—which can be shifted along the chain. An angle yoke is welded to each hook, and these are reinforced with gusset plates. A bolt with a wingnut goes through the end of each yoke.

In use, the sling is adjusted by opening the bolt and wingnut, then slipping a chain link into the yoke and replacing the bolt. The chain cannot slip because the link below the one in the yoke is at right angles to the yoke slot. For extra safety a hole is drilled and tapped into each plate hook to take a tightening screw—which will prevent shifting of the plate when it is raised. *H. G. Frommer, Milwaukee, Wis.*



Skiving Tool Finishes After Heavy Roughing Cut

TO FINISH-TURN some small spindles after a breakdown tool had been used to form the profile, we utilized a skiving tool on the rear toolslide of a lathe. The tool was simple to make, easy to keep in shape with light grinding passes, and adaptable for automatic work.

The tool itself was held in the holder at a 5° rake angle, which simplified grinding. The skiving angle is 10°, which makes the tool cut only about a $\frac{1}{8}$-in.-wide chip at any time. Cut depth is 0.007 in., and tool life is roughly three times longer than that of the roughing tool. *Albert E. Reiff, Farmingdale, L. I., N. Y.*

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for the best

PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT — $25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

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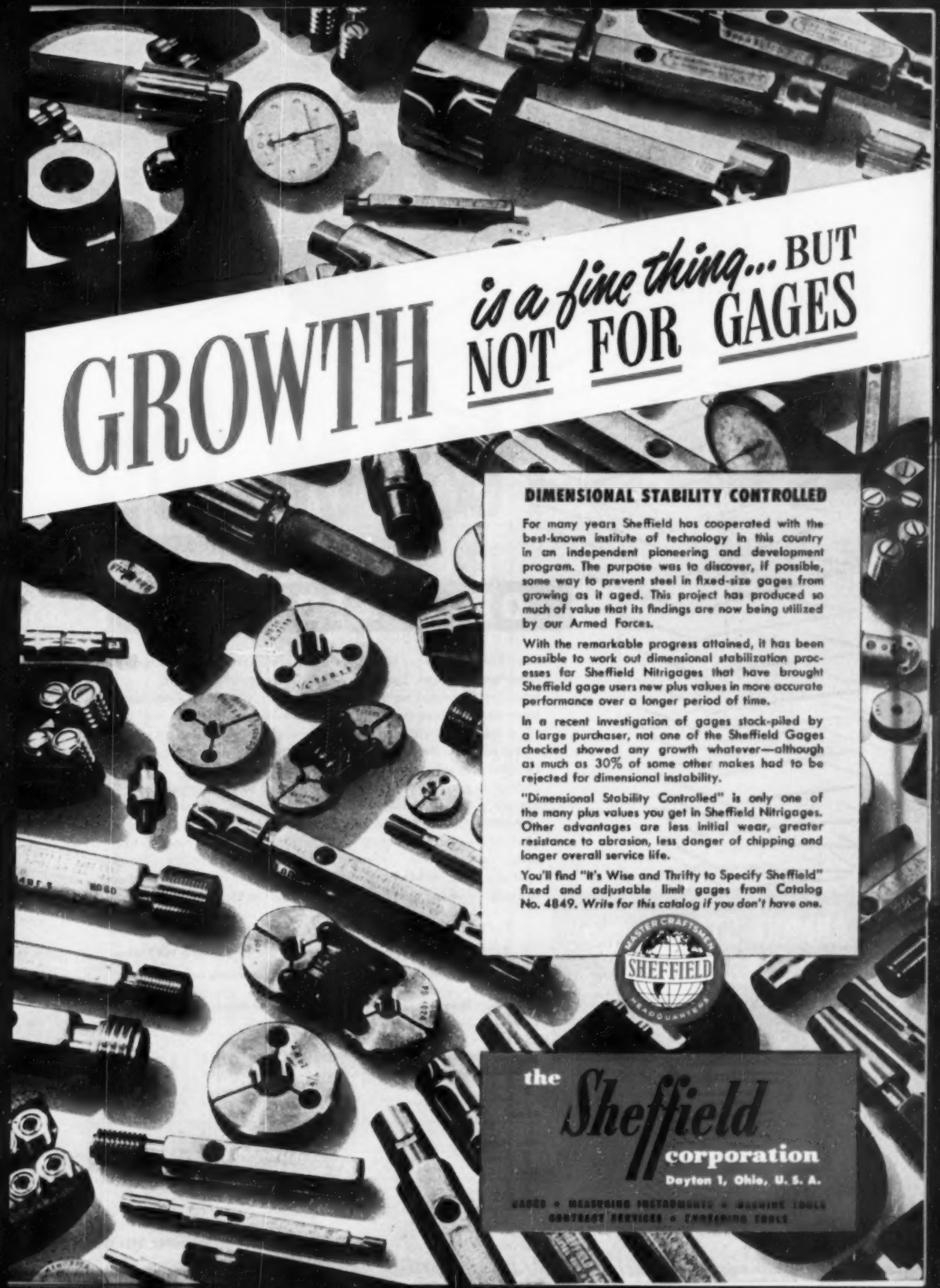
HOW TO ENTER —Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

112th Winner:
(Sept. 4 Issue)

O. Ernest Riegner
Automatic Die Stop


GROWTH is a fine thing... BUT NOT FOR GAGES
DIMENSIONAL STABILITY CONTROLLED
For many years Sheffield has cooperated with the best-known institute of technology in this country in an independent pioneering and development program. The purpose was to discover, if possible, some way to prevent steel in fixed-size gages from growing as it aged. This project has produced so much of value that its findings are now being utilized by our Armed Forces.
With the remarkable progress attained, it has been possible to work out dimensional stabilization processes for Sheffield Nitrigages that have brought Sheffield gage users new plus values in more accurate performance over a longer period of time.
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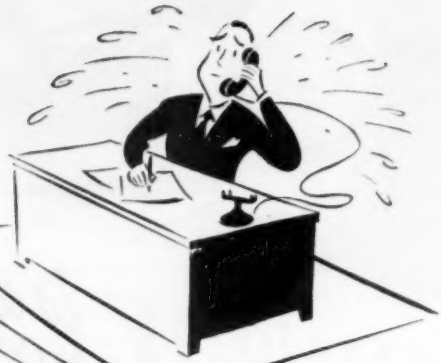

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Steep-Taper Arbors and Collet Shanks

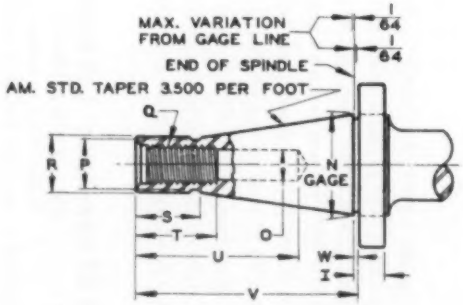
for Milling and Boring Machines

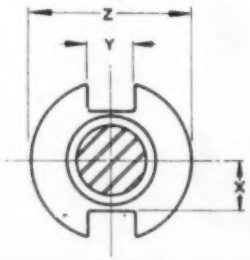
This is a tentative standard developed by the Joint Industry Committee of the automotive industry. The purpose of the design is to save setup time and duplication of expensive cutters in toolroom work. Quick-change adaptors are to be used.

ESSENTIAL DIMENSIONS FOR ENDS OF ARBOR AND COLLET SHANKS

TAPER SIZE NUMBER	GAGE DIAMETER OF TAPER	DRILL CLEARANCE FOR DRAW-IN BOLT	DIAMETER OF NECK	SIZE OF THREAD FOR DRAW-IN BOLT	PITCH DIAMETER		PILOT DIAMETER	LENGTH OF PILOT	LENGTH OF PERFECT THREADS	DEPTH OF CLEARANCE HOLE	DISTANCE FROM REAR OF FLANGE TO END OF ARBOR	CLEARANCE OF FLANGE FROM GAGDIA. DIAMETER	BOTTOM OF SLOT TO ℄ OF FLANGE	WIDTH OF DRIVING SLOT	FLANGE DIAMETER	WIDTH OF FLANGE PLUS CLEARANCE
	N	O	P	Q	MAX.	MIN.	R	S	T	U	V	W	X	Y	Z	I
5	1/2	.1495	17/64	10-24	.1629	.1605	.2995 .2975	7/16	9/16	7/8	1-5/32	1/32	.265 .250	.265 .255	3/4	.253 .250
* 10	5/8	.201	21/64	1/4-20	.2175	.2149	.3655 .3635	1/2	3/4	1	1-13/32	1/32	.327 .312	.390 .380	1	.253 .250
15	3/4	.201	13/32	1/4-20	.2175	.2149	.440 .438	9/16	3/4	1	1-21/32	1/32	.390 .375	.390 .380	1-3/16	.253 .250
* 20	7/8	5/16	29/64	3/8-16	.3344	.3312	.490 .488	5/8	7/8	1-11/16	1-31/32	1/32	.452 .437	.390 .380	1-3/8	.253 .250
25	1	5/16	17/32	3/8-16	.3344	.3312	.565 .563	11/16	7/8	1-11/16	2-9/32	1/32	.515 .500	.515 .505	1-9/16	.253 .250
* 30	1-1/4	27/64	41/64	1/2-13	.4500	.4463	.675 .673	13/16	1	2	2-3/4	1/16	.640 .625	.640 .630	2	.376 .375
35	1-1/2	27/64	25/32	1/2-13	.4500	.4463	.799 .797	7/8	1	2	3-3/16	1/16	.796 .781	.640 .630	2-3/8	.378 .375
* 40	1-3/4	17/32	15/16	5/8-11	.5660	.5616	.987 .985	1	1-1/8	1-15/16	3-3/4	1/16	.890 .875	.640 .630	2-3/4	.440 .437
† 42-1/2	2	17/32	1-5/64	5/8-11	.5660	.5616	1.128 1.126	1	1-1/8	1-15/16	4-1/16	1/16	1.015 1.000	.765 .755	2-15/16	.440 .437
45	2-1/4	17/32	1-3/16	5/8-11	.5660	.5616	1.237 1.235	1	1-1/8	1-15/16	4-3/8	1/16	1.171 1.156	.890 .860	3-1/2	.503 .500
* 50	2-3/4	7/8	1-1/2	1-8	.9188	.9134	1.549 1.547	1	1-3/4	3-1/2	5-1/8	1/8	1.390 1.375	1.018 1.006	4-1/2	.628 .625
55	3-1/2	7/8	1-15/16	1-8	.9188	.9134	1.587 1.985	1-1/2	1-3/4	3-1/2	6-5/16	1/8	1.796 1.781	1.018 1.006	5-1/2	.753 .750
* 60	4-1/4	1-7/64	2-9/32	1-1/4-7	1.1572	1.1513	2.361 2.359	1-3/4	2-1/4	4-1/4	6-5/16	1/8	2.400 2.390	1.018 1.006	6-1/2	.753 .750

* Standard milling machine sizes. † Special purpose design for boring machines.





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American Machinist REFERENCE BOOK SHEET

Calculations for Acme Thread Gages...I

BY D. SWEET, Tool Designer,
UNITED SHOE MACHINE CO.

Formulas needed to compute the major, pitch and minor diameters of Acme thread gages are scattered over several pages of the National Bureau of Standards Handbook H-28 (1944).

Further reference to several tables also scattered throughout the text is needed to solve these formulas. It is the purpose of these Reference Sheets to simplify and coordinate this information to aid the designer who is already familiar with the types of thread, classes of fits and the gages needed to check these elements.

Tables 5, 6, and 7 give the formulae needed to compute the major, pitch, and minor diameters of the Go and Not Go plug gages, the Go and Not Go ring gages, and the Go and Not Go setting plugs.

Table 8 gives the formulae for the Not Go plug used to check the major diameter of the centralizing fits.

Tables 5, 6, 7, and 8 cover both types of thread (general purpose and centralizing) and all classes of fits. Each formula has a tolerance in the next column and an indication of its direction plus or minus.

Symbols used are:

D = Max. major dia of screw or nominal size of thread
$E = D - \text{Pitch}/2$
$K = D\text{-Pitch}$
$B = D - 0.025\sqrt{D}$
$E_c = B - \text{Pitch}/2$
$K_c = B - \text{Pitch}$
P = Pitch

General-Purpose Type:
$2G$ = Class 2 Fit
$3G$ = Class 3 Fit
$4G$ = Class 4 Fit

Centralizing Type
$2C$ = Class 2 Fit
$3C$ = Class 3 Fit
$4C$ = Class 4 Fit
$5C$ = Class 5 Fit
$6C$ = Class 6 Fit

Numbers in parentheses refer to columns in Tables 1, 2, 3, 4, which contain the allowances and tolerances for all sizes and threads per inch. These tables are taken from several tables scattered over several pages of the Handbook H28. Each column is numbered so that when the formula for a certain diameter is for example $D + (8)$ or $E - (21)$ the designer looks in column 8 or 21. Opposite the number of threads per inch or nominal size of wanted thread he finds a figure which he either adds or subtracts from D or E, for example: $D + .010"$ or $E - .0012"$.

Some gage designers recognize the fact that the Go and Not Go setting plugs, which are used solely to set the Go and Not Go ring gages, do a better job if they are truncated on the major diameter, thus minimizing the lead and thread-angle errors. For this reason, the formulas for both the full form and the truncated design are included in the table for the setting plugs.

Examples:

I. Design a Go plug gage for a ¼-16 Acme (NA) Thread Class 3G.

The formulas for the Go plug gages are found in Table 5. For the major diameter opposite class of fit 3G the formula is found to be $D + (8)$, the tolerance given in the next column is (7) and a plus sign in the next column gives its direction. To complete the formula look in col. 8, Table 2, opposite the number of threads per inch (16) and find a number (0.005). Add this figure to D, which is the nominal size of the thread; thus $D + (8) = 0.250 + 0.005 = 0.255$ in.

From Col. 7, Table 2, get the tolerance of 0.001 in., which we apply plus as indicated in Table 5. Thus, major diameter = 0.255-0.256 in.

For the pitch diameter, class of

ALLOWANCES AND TOLERANCES, INCHES

TABLE 1

NOM. THD. SIZE	1
0.825	.0001
1.510	.00012
2.510	.00016
4.510	.0002
6.510	.00025
9.010	.00032
12.010	.0004

TABLE 2

THDS. PER INCH	2	3	4	5	6	7	8	9
16	.00750	.00350	.00250	.0006	.0005	.001	.005	.01
14	.00802	.00374	.00267	.0006	.0005	.001	.005	.01
12	.00866	.00404	.00289	.0006	.0006	.001	.005	.01
10	.00949	.00443	.00316	.0007	.0006	.002	.010	.01
8	.01061	.00495	.00354	.0008	.0007	.002	.010	.01
6	.01225	.00572	.00408	.0009	.0007	.002	.010	.01
5	.01342	.00626	.00447	.0010	.0008	.002	.010	.01
4	.01500	.00700	.00500	.0011	.0008	.002	.010	.01
3	.01732	.00808	.00577	.0013	.0008	.002	.010	.01
2½	.01897	.00885	.00632	.0014	.0009	.002	.010	.01
2	.02121	.00990	.00707	.0015	.0010	.002	.010	.01
1½	.02449	.01143	.00816	.0018	.0010	.002	.010	.01
1⅓	.02598	.01212	.00866	.0018	.0010	.002	.010	.01
1	.02000	.01400	.01000	.0021	.0010	.002	.010	.01

TABLE 3

NOM. THD. SIZE	10	11	12	13	14	15	16	17	18
¼	.00300	.00140	.00100						
5/16	.00335	.00157	.00112						
⅜	.00367	.00171	.00122						
7/16	.00397	.00185	.00132						
½	.00424	.00198	.00141	.0007	.0100	.0025	.0014		
9/16	.00474	.00221	.00158	.0008	.0125	.0028	.0016		
⅝	.00520	.00242	.00173	.0009	.0167	.0030	.0017		
11/16	.00561	.00262	.00187	.0009	.0167	.0033	.0019		
1	.00600	.00280	.00200	.0010	.0200	.0035	.0020		
1 1/16	.00636	.00297	.00212	.0011	.0200	.0037	.0021	2	.0012
1 1/8	.00671	.00313	.00224	.0011	.0200	.0039	.0022	2	.0012
1 3/16	.00704	.00328	.00235	.0012	.0250	.0041	.0023	2	.0015
1 1/4	.00735	.00343	.00245	.0012	.0250	.0043	.0024	2	.0015
1 3/8	.00794	.00370	.00265	.0013	.0250	.0046	.0026	2	.0015
2	.00849	.00396	.00283	.0014	.0250	.0049	.0028	2	.0019
2 1/4	.00900	.00420	.00300	.0015	.0333	.0052	.0030	2½	.0019
2 1/2	.00949	.00443	.00316	.0016	.0333	.0055	.0032	2½	.0019
2 3/4	.00993	.00469	.00332	.0017	.0333	.0058	.0033	2½	.0019
3	.01039	.00485	.00346	.0017	.0500	.0061	.0035	3	.0019
4	.01200	.00560	.00400	.0020	.0500	.0070	.0040	3	.0027
5	.01342	.00626	.00447	.0022	.0500	.0078	.0045	3	.0039

TABLE 4

NOM. THD. SIZE	19	20	21
1/16	.0024	.0018	.0012
5/64	.0040	.0030	.0020
7/64	.0049	.0037	.0024
9/64	.0057	.0042	.0028
11/64	.0063	.0047	.0032
13/64	.0069	.0052	.0035
15/64	.0075	.0056	.0037
1 1/16	.0080	.0060	.0040
1 1/16	.0085	.0064	.0042
1 3/16	.0089	.0067	.0045
1 1/16	.0094	.0070	.0047
1 5/16	.0098	.0073	.0049
1 7/16	.0105	.0079	.0052
2 1/16	.0113	.0085	.0057
2 3/16	.0120	.0090	.0060
2 5/16	.0126	.0095	.0063
2 7/16	.0133	.0099	.0066
3 1/16	.0140	.0105	.0070
3 3/16	.0150	.0112	.0075
4 1/16	.0160	.0120	.0080
4 3/16	.0170	.0127	.0085
5 1/16	.0181	.0136	.0091

For intermediate sizes in Tables 1, 3, and 4 use next higher size. Note: first line in Tables 1, 3, and 4 cover sizes from 0 up to and including first size. An increase of 10% is recommended in Table 4 for each inch or fraction thereof that the product length of engagement exceeds two diameters.

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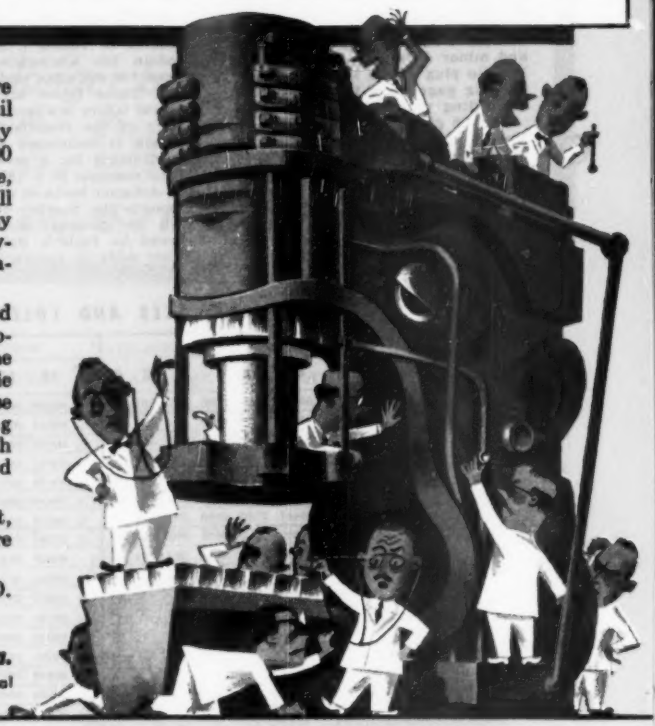

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Calculations for Acme Thread Gages...II

fit 3G, the formula is E, the tolerance is (6) and its direction plus. $E = D$ — Pitch/2 = 0.250-0.0625/2 = 0.250-0.03125 = 0.21875 in. The tolerance is + .0005 in. Pitch diameter = 0.2187-0.2192 in.

For the minor diameter, class of fit 3G, the formula is found to be K — (9), the tolerance is (7) and its direction plus. $K = D$ — Pitch = 0.250-0.0625 = 0.1875 in.

K — (9) = 0.1875-0.01 = 0.1775 in. The tolerance is + 0.001 in. Minor diameter = 0.1775-0.1785 in.

II. Design a Not Go ring gage for a 1¼-4 NA Thread Class 4G. From Table 6: Major dia. = D + (9), tolerance = (7) minus.
D + (9) = 1.250 + 0.01 = 1.260 in.
Tolerance = — 0.002 in. Major diameter = 1.260-1.258 in.
Minor dia = $K + P/4$
$K = D$ — Pitch = 1.250-0.250 = 1.000 in.
$K + P/4$ = 1.000 + 0.250/4 = 1.000 + 0.0625 = 1.0625 in.
Tolerance (7) plus = + 0.002 in.
Minor dia = 1.0625 — 1.0645 in.

We need a setting plug to set the pitch diameter.
From Table 7

Major dia = D (Full Form) = 1.250 in. = D — $P/6$ (Truncated) = 1.250 — 0.250/6 = 1.250 — 0.0416 = 1.2084 in.
Tol. (7) plus (Full Form) = +0.002 in.
(7) minus (Truncated = — 0.002 in.
Major dia (Full Form) = 1.250-1.252 in.
Major dia (Truncated) = 1.2084-1.2064 in.
Pitch dia = E — (21)-(4)-(12)
Tol. = (6) plus
E = D-Pitch/2 = 1.250-0.250/2 = 1.250-0.125 = 1.125 in.
E-(21)-(4)-(12) = 1.125-0.0045-0.0011-0.00224 = 1.113 in.
Tol. (6) plus = 0.0008 in.
Pitch dia = 1.1133-1.1141 in.

A footnote tells us that the minor diameter of the setting plugs can be any diameter that clears the minimum minor diameter of the ring gage.

NOTE: NUMBERS IN PARENTHESIS REFER TO COLUMNS IN TABLES . . 1-2-3 & 4

Table 5...."GO"-"NOT GO" PLUG GAGES

DIA.	GAGE	CLASS OF FIT	FORMULA	TOL.	±
MAJOR	GO	2G, 3G, 4G	D+(8)	(7)	+
		2C, 3C, 4C	D+(13)	(1)	+
		5C, 6C	B+(13)	(1)	+
	NOT GO	2G, 3G, 4G 3C, 3C, 4C	D—P/4	(7)	—
		5C, 6C	B—P/4	(7)	—
PITCH	GO	2G, 3C	E	(5)	+
		3G, 4G 3C, 4C	E	(6)	+
		5C, 6C	Ec	(6)	+
	NOT GO	2G, 2C	E+(2)+(10)	(5)	—
		3G, 3C	E+(3)+(11)	(6)	—
		4G, 4C	E+(4)+(12)	(6)	—
		5C	Ec+(3)+(11)	(6)	—
		6C	Ec+(4)+(12)	(6)	—
MINOR	GO & NOT GO	2G, 3G, 4G	K—(9)	(7)	+
		2C, 3C, 4C	K+(14)—(9)	(7)	+
		5C, 6C	Kc+(14)—(9)	(7)	+

The major diameter of the centralising Go plug gage should be chamfered equally at the crest of the thread—45°—to leave a flat of $0.28P + 0.000\text{-}0.02P$.

Table 6...."GO"-"NOT GO" RING GAGES

DIA.	GAGE	CLASS OF FIT	FORMULA	TOL.	±
MINOR	GO & NOT GO	2G, 3G, 4G 2C, 3C, 4C	D+(9)	(7)	—
		5C, 6C	B+(9)	(7)	—
MAJOR	GO	2G, 3G, 4G	K—(8)	(7)	—
		2C	K+(14)—(19)	(7)	—
		3C	K+(14)—(20)	(7)	—
		4C	K+(14)—(21)	(7)	—
		5C	Kc+(14)—(19)	(7)	—
		6C	Kc+(14)—(20)	(7)	—
	NOT GO	2G, 3G, 4G 2C, 3C, 4C	K+P/4	(7)	+
		5C, 6C	Kc+P/4	(7)	+

The pitch diameter of the Go and Not Go ring gages are set and therefore equal to the pitch diameter of the Go and Not Go setting plugs.

Table 7...."GO"-"NOT GO" SETTING PLUGS

DIA.	GAGE	CLASS OF FIT	FORMULA	TOL.	±
MAJOR	GO & NOT GO	3G, 2C 3G, 3C 4G, 4C	(FULL FORM) D	(7)	+
			(TRUNCATED) D—P/6	(7)	—
		5C, 6C	(FULL FORM) B	(7)	+
			(TRUNCATED) B—P/6	(7)	—
PITCH	GO	2G, 2C	E—(19)	(5)	—
		3G, 3C	E—(20)	(6)	—
		4G, 4C	E—(21)	(6)	—
		5C	Ec—(19)	(6)	—
		6C	Ec—(20)	(6)	—
	NOT GO	2G, 2C	E—(19)—(2)—(10)	(5)	+
		3G, 3C	E—(20)—(3)—(11)	(6)	+
		4G, 4C	E—(21)—(4)—(12)	(6)	+
		5C	Ec—(19)—(3)—(11)	(6)	+
		6C	Ec—(20)—(4)—(12)	(6)	+

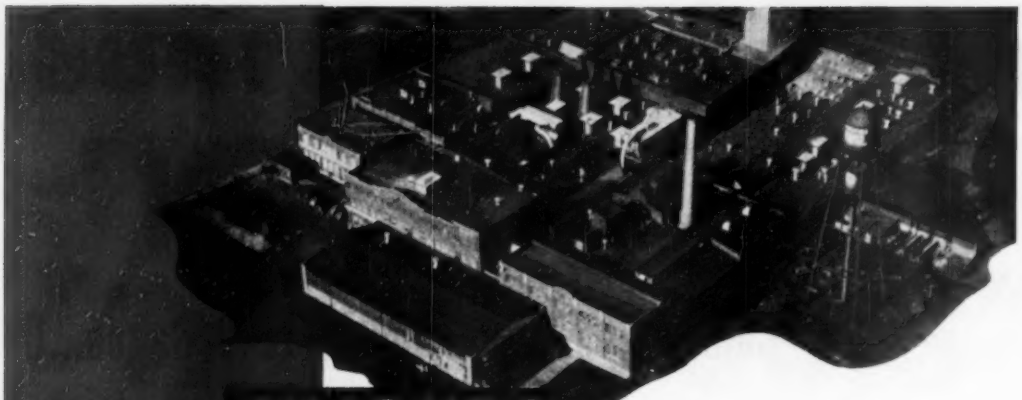
For centralising Go setting plugs (sizes over 1 in.), if the product length of engagement is greater than the length of the ring gage in Col. 17, the pitch diameter will be further reduced by the amount in Col. 18. Example: For Class 2C the pitch diameter equals E-(19)-(18).

Table 8...."NOT GO" PLUG
(for checking major dia. of centralising thds. only)

DIA.	FIT	FORMULA	TOL.	±
MAJOR	2C, 3C	D+(13)+(15)	(1)	—
	4C	D+(13)+(16)	(1)	—
	5C	B+(13)+(15)	(1)	—
	6C	B+(13)+(16)	(1)	—
PITCH	2C, 3C, 4C	E—(21)	2×(6)	—
	5C, 6C	Ec—(20)	2×(6)	—
MINOR	2C, 3C, 4C	K+(14)—(19)	(7)	+
	5C, 6C	Kc+(14)—(9)	(7)	+

The major diameter of the Not Go plug (for major diameter centralizing type only) should be chamfered 45° equally to leave a flat at the crest of the tread of not over $0.24P$ with an approximate depth of $0.7P$.

The minor diameter of the Go and Not Go setting plugs equals any diameter that clears the minor diameter of the Go and Not Go ring gages.



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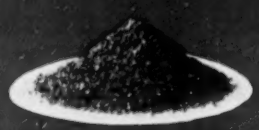

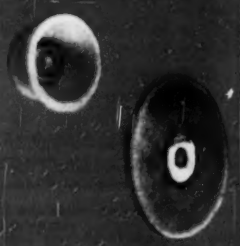

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Pix Fax

ABOUT A YEAR AGO, we published a one-page article telling how ATF, Inc., spearheaded worker-education programs with cartoon posters that appealed to the personal interest of their employees. Only recently, we learned that an Opinion Research survey had provided ATF with tangible evidence of the effectiveness of this approach. In checking employee beliefs on a number of important questions pertaining to industry and its operation, the survey revealed that on many questions ATF employees were far ahead of the national average in knowing the right answers. But on questions that had not been covered in the various media through which ATF reaches its people, employees were behind the national averages in their knowledge. The point: Here is more proof that industry can do a job in employee education when it adopts a human-relations approach and puts its message in terms of Joe, his interests, and his family.

Blocks

IBM MAKES EXTENSIVE USE of gage blocks at Endicott, N.Y. Currently, 155 sets are in the shop. Sets are classified by accuracy, class 1 being those under 20 millionths inch error; Class 2, over 20 but under 40; Class 3, over 40 but under 80 millionths error. Class 1 sets are used in gage making and are demoted as error increases to Class 2, then to Class 3 for heavy machining. A large stock of spare blocks is maintained to replace damaged individual blocks. In many cases, individual gage blocks have replaced flat gages for shop use; the flat gages cost several times as much, are treated far more carelessly by workmen who know gage blocks are accurate and costly, hence handle them with kid gloves.

Daffynitions

QUICK JOKE: jest propulsion. SHORE LEAVE: erosion. SWEET ADELINE: big hit when the bases are loaded. PROHIBITIONIST: one who goes against the grain. COURTSHIP: interval between lipstick and mopstick. DIAPER: changeable seat cover. ATOMIC WARFARE: fine kettle of fission. WEDDING: aisle-altar-hymn. OVERBEARING: what some television actresses are. FLYING SAUCER: result of insult to cook. BACHELOR: fellow who'd rather miss the kisses than kiss the missus. FLAW OF AVERAGES: cause of poker losses. GRAB BAG: lady hoarder. FOOTBALL STAR: hero today, yawn tomorrow.

Old Homestead

APPRENTICES at General Electric Co., Ltd., England, are now housed in an old English manor house, Castle Bromwich Hall, built in 1560. Electrically equipped kitchens and other modern amenities have been installed without detracting from the interest and beauty of the building.

Guess Cooling

COOLANT used at Chevrolet-Muncie for gear hobbing and shaping is a hit-and-miss mixture of reclaimed oils from all plant operations. Percentages of lard and sulfurized oils are high, but even hydraulic oil and machine lube oil are included. Carl Proffer, plant supt., claims it is the best cutting fluid thus far found for gear cutting. Apparently, real research on coolants is indicated for gear cutting (*AM*, Sept. 18, p110).

Obsolete Man

DESIGN OF THE HUMAN BODY is becoming the main stumbling block in development of high-speed planes, according to Dr. N. E. Edlefsen, associate technical director of the Aerophysics Lab at North American Aviation. Says he: "His (the pilot's) design has not changed perceptibly in thousands of years, nor will it probably change to any extent in the near future. Operating speeds of today's military airplane are making the reaction time of the human body a stumbling block in the path of progress."

Present 600-mph interceptors approach each other at 1 mile in 3 sec, so the pilot can't react quickly enough to fire his guns after he recognizes his enemy. The answer will probably be electronic push-button control of both flight and firing. Such controls may even be capable of preventing the plane from damaging itself.

News of Metalworking

DEVELOP GAS TURBINE—Of the $3,857,500 to be spent by Boeing Airplane Co. for research, manufacturing and operating equipment, a "substantial" amount is earmarked for development of Boeing's lightweight gas turbine.

ASSEMBLY LINE SAVINGS—Automatic assembly line reconditioning of spark plugs has saved the Air Force $114,500 in six months, allows 86 people at Kelly AF base (San Antonio, Tex.) to turn out 18,000 clean, tested plugs daily, as compared to manual method by which 200 workers processed 10,000 plugs daily.

TO BUILD SHIPS—Naval construction and conversion program provides for conversion and modernization of 170 vessels, a few in private yards; building of 172 small ships and craft. Construction of practically all of the following will be awarded to private builders: eleven 165-ft mine sweepers, 18 mine sweeping boats, 113 landing craft, and 30 500-ton lighters.

PRIVATE PLANES BOW OUT—Ryan Aeronautical Co. will suspend production of Navion personal-business planes next year to concentrate facilities on military production. The change will not interrupt production of the first release of 150 1951-model Navions already in the works.

DO Ratings Confusing to Industry; NPA Busy Explaining Priority System

WASHINGTON—Industry is confused about the "DO" system of priority rating of defense contracts. The National Production Authority's Machinery Division has received many requests for clarification and interpretation of the priorities system, particularly as affecting production equipment.

One cause for much of the confusion is the misunderstanding by metalworking companies of such terms as "materials," "persons," "production equipment," and others which run through NPA's Regulation 2 outlining the DO rating system. Industry's understanding of the terms isn't always the meaning intended by the legal minds who wrote the regulation. (See definitions in box on next page.)

"Production equipment," for example, should not be confused with capital equipment, which is an accounting term. Production equipment includes cutting tools, abrasives, dies, jigs, fixtures, hand tools, etc. It would not include cutting oils, lubricants, and such items which are not equipment and are regarded as operating supplies.

• **DO ratings which apply to production equipment**—There's considerable confusion, also, about what DO ratings are being used to order production equipment. (See complete list of identifying digits below.) The following DO digits apply to production equipment:

DO-21 is being applied by the Dept. of Defense on its own purchase orders.

DO-22 is used for Dept. of Defense construction, which may include items of equipment going into the project being constructed.

DO-98 may be assigned by the armed services contracting officers in the field to be used by their contractors or sub-contractors on a specific order for production equipment.

DO-03 will sometimes be used for equipment to go aboard a ship, or DO-04 for equipment to be incorporated in a mobile repair shop unit. In these two cases the production equipment would be incorporated into the end products.

DO-40, DO-43, DO-44, DO-50, and DO-60 are being used for rating orders for production equipment, except for construction, when DO-41, DO-51, and DO-62 may be used to rate orders for equipment going into projects being constructed.

DO-01 to DO-11, inclusive, are to be extended only for materials to

Identifying Digits Used In Assigning DO Ratings

Dept. of Defense
- DO-01 Aircraft
- DO-02 Guided missiles
- DO-03 Ships
- DO-04 Tank-automotive
- DO-05 Weapons
- DO-06 Ammunition
- DO-07 Electronic & communication equipment
- DO-08 Fuels and lubricants
- DO-09 Clothing and equipage
- DO-10 Transportation equipment
- DO-11 Building supplies & equipment for overseas (troop) construction
- DO-21 Miscellaneous
- DO-22 Dept. of Defense construction (contract)
- DO-98 Production equipment for certain contractors

Atomic Energy Commission
- DO-40 Operations
- DO-41 Construction, except construction equipment
- DO-42 Construction equipment
- DO-43 Prime & sub-contractor's privately-owned facilities
- DO-44 Other privately-owned facilities

National Advisory Committee for Aeronautics
- DO-50 Operations
- DO-51 Construction

U. S. Coast Guard
- DO-60 Miscellaneous
- DO-61 Aircraft
- DO-62 Construction
- DO-63 Ships

30% Time Saved in Erecting Aircraft Fixtures

FARMINGDALE, L.I., N.Y.—An optical system for erecting aircraft fixtures that will provide interchangeability without masters was disclosed here by Republic Aviation Corp.

This system, developed in cooperation with the U. S. Air Force, permits savings in erection time estimated at approximately 30 to 40% over former methods, accuracies to 0.0015 in. in 50 ft for horizontal and vertical displacement and to 6 sec for angularity, and erection of fixtures by people who are not highly skilled mechanics. Under development for the past three years, the new system is expected to be of real value in current industrial mobilization planning.

In the new method, points in space are established with reference to an optical line of sight as the datum line. This line is established by coordinating the alignment of a telescope positioned at one end of the assembly fixture with an illuminated target at the opposite end or at an intermediate point of the fixture. Intermediate points at any desired spacing may be related to the datum line by aligning an illuminated target on a universal positioning tool with the line of sight of the telescope. When the target is properly in line, a working surface attached to the positioner then is in the proper location in space over the basic fixture frame and can be anchored with Cerro-alloy.

be incorporated in the end products (including packaging and chemicals used directly in the production) for which rated orders are received. (Note below the definition of "materials.")

A manufacturer of common components of shelf items, who has a number of rated orders for which he cannot place orders for minimum commercially procurable quantities of materials to fill the rated orders individually, may place one rated order for all the materials, using the symbol DO-99.

• **Selection of production equipment** items to be rated is left to the discretion of the government contracting officer on an individual order basis, provided the request meets the criteria set forth by the Munitions Board and is within the limitations of the dollar quota established.

No contractor or subcontractor for the Dept. of Defense has been given blanket authority to use a DO rating for production equipment without prior approval of the specific items by the contracting officer. However, purchases of production equipment for the government by the governmental agencies or authorized contractor may be rated without specific authorization.

• **For maintenance, repair** and operating supplies, no priority assistance can be obtained. There is misunderstanding on this point on the part of some suppliers. The DO ratings are to assist defense production, it is emphasized, and are not authorized on an industry or product basis.

What NPA Terms Mean

Material—Any raw, in process, or manufactured commodity, equipment, component, accessory, part, assembly, or product of any kind.

Production Equipment—Equipment used in producing goods or services, such as the following: Equipment for cutting, abrading, grinding, shaping, forming, measuring, testing, heating, treating of production materials in manufacture or for the handling of equipment or production materials or (in process) products within a manufacturing, processing, assembling, or service establishment.

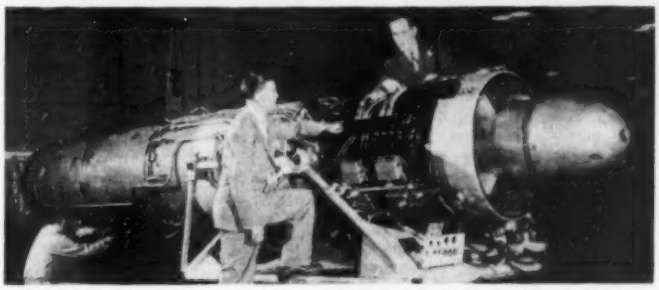
Persons—Any individual, corporation, partnership, association, or any other organized group of persons. Also any agency of the United States or any other government.

Assignment—The granting of authority to a firm to use or apply the rating. (It is not the first appliance of the rating, as assignment was defined in WPR.)

Application—The first affixing of the rating to a purchase order by the firm to whom the right has been assigned.

Extension—Any subsequent affixing of ratings after the application.

ONE OF MAIN ASSEMBLY LINES at Lynn where GE J-47 engines are being assembled prior to their "green" run in test cells



THIS JET ENGINE, first to incorporate major reductions in strategic materials, is made ready for test. Designated the J-47-GE-17, the engine is equipped with an afterburner for greatly added thrust

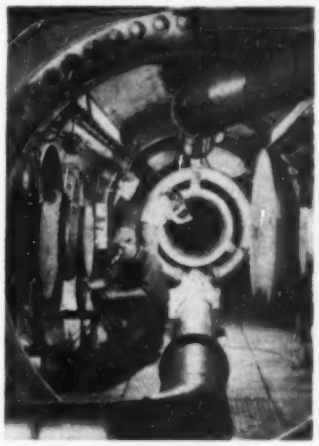
GE Shows New Gas Turbine Laboratory

LYNN, MASS.—At dedication ceremonies for General Electric's new multi-million dollar Aircraft Gas Turbine Laboratory held here Nov. 14, the public got its first glimpse of testing facilities where altitudes of 70,000 ft and temperatures of −100 F can be simulated.

Heart of the laboratory is the 40-ft long, insulated and pressurized steel cylinder where experimental compressors for future engines are tested. Nearly 700 measuring instruments record performance of the compressor while it is in operation.

Importance of the laboratory was indicated by C. W. LaPierre, manager of the Aircraft Gas Turbine Divisions, when he stated that "the compressor offers the greatest opportunity for improvement in designing the turbine engines that will go into tomorrow's planes."

In a dedicatory address, GE President C. E. Wilson declared that the gas turbine might never have been developed but for existence of large private concerns. He said that because of introduction of this type of engine, "the aircraft industry will continue to grow, and not wither away. Unlike the automobile industry, its vigor is not impaired by chrome-fever. It is still seeking the ultimate objective, which is to carry man and his burdens through the air as fast, as efficiently, and as cheaply as possible. The purveyors of automotive transportation have lost sight of one or two of those considerations."



STEEL CYLINDER where experimental compressors are tested.

Sales Represesentatives Named

• **Simmons Machine Tool Corp.,** Albany, N. Y., has been named overseas distributor for all Kling metalworking machinery by Kling Bros. Engineering Works, Chicago. Simmons export offices are in New York City.

• **Hauser Machine Tool Corp.,** Manhasset, N. Y., has been named exclusive U. S. representative for Leo Hjort Co., Copenhagen, Denmark. Hauser will import all sizes of Hjort keyless, self-centering drill chucks.

• **Russell, Holbrook & Henderson, Inc.,** New York, has been named American representatives of Mikron, S.A., of Bienne, Switzerland, manufacturers of precision hobbing machines for production of gears, worms, and worm wheels.

• **Tool Equipment Co.,** Chicago, has been named exclusive sales representative for Barth Stamping & Machine Works, Inc., Cleveland, for Illinois, Wisconsin, Iowa, and northern Indiana.

• **National Tool Co., Cleveland,** has appointed Tri-State Machinery Co., Pittsburgh and Erie, Pa., its sales agent in western Pennsylvania.

Fifth-Round Wage Settlements Follow Cost-of-Living Pattern

WASHINGTON — Most fifth-round wage settlements in metalworking have been around 10 cents an hour, with most companies going along with the General Motors cost-of-living wage escalator clause and many of them agreeing also to the 4¢ "annual improvement" factor.

This pattern may change for those companies dealing with the CIO United Steelworkers and others whose settlements will come after steel. Steelworkers President Philip Murray is after more than 10 cents, and he is reluctant to tie wages to the cost-of-living index. The union got almost 15 cents an hour, voluntarily, from Aluminum Co. of America, so it is expected that Mr. Murray will not accept less than that from the steel industry without some other concessions.

• **Negotiations with U. S. Steel** will be resumed now that the CIO convention is out of the way. A settlement, without a strike, is expected before the Dec. 31 deadline.

For identical reasons, the unions are bargaining "tough" and employers are putting up relatively little opposition. Those reasons are the growing scarcity of labor and the prospect for wage controls early next year. Management doesn't want to get caught with its wages down in a tight labor market. And the unions know this strengthens their bargaining position. Besides, business is good.

Metal fabricating companies which followed the General Motors formula, with possibly some modifications, include International Harvester, Chase Brass & Copper, General Electric and major automobile manufacturers.

• **Metalworking led all other** industries in the number of employees who received wage increases during September, according to reports reaching the Bureau of Labor Statistics. Three-fourths of the employees who got wage increases that month were in metalworking.

The cost-of-living escalator, BLS found, has become extremely popular. During the first nine months of this year, BLS received about 85 contracts containing both the escalator and "annual improvement" rise.

Latest Defense Awards: Automotive and Aircraft

ARMY

Federal Motor Truck Co., Detroit, bushings, front & rear axle brake shoe; carrier differential assembly, $229,000; shoes, front axle brake assembly, $343,995; pins, bolts, tubes, etc., $423,511; housings, sleeve, guard, socket, $315,453; gear flanges, $100,612.

Kenworth Motor Truck Corp., Seattle, gages, carrier, bearing, elbow, carrier & cap assembly, $398,870; joint, front axle universal assembly, $421,382.

New Process Gear Co., Syracuse, N. Y., transmission assembly, $767,960; transfer cases, $114,000.

Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., box master junction and spare parts, $200,000.

Hall-Scott Motor Div., ACF-Brill Motors Co., Philadelphia, baffles, bases, bushings, chain drives, flanges, gaskets, etc., $485,950.

Dunbar Kaple, Inc., Geneva, Ill., ¼-ton cargo trailers, $1,632,286.

Junior Toy Corp., Hammond, Ind., metal parts for supplementary charge assembly, $221,432.

Littleford Bros., Cincinnati, water tanks, $266,454.

Gil Boers Equipment Co., Chicago, welders, $202,057.

Nesco, Inc., Milwaukee, cartridge cases, $257,254.

Jaques Power Saw Co., Denison, Tex., cargo trailers, $768,620.

Mack Mfg. Co., Plainfield, N. J., retainer, housing, bell, pipe, bracket shim set, carrier, lever, etc., $126,126.

GMC Truck & Coach Div., Pontiac, Mich., bushings, crankshaft, insulator, link, etc., $265,550; **Chevrolet Motor Div.,** ½-ton carryall trucks, $677,473.

Republic Steel Corp., Bolt & Nut Div., Cleveland, bolts, $1,868,000.

Motor Wheel Corp., Lansing, Mich., hub, wheel w/drum assembly, $223,685.

Budd Co., Detroit, rings, side, tire rim, wheel assembly, $237,925; wheel assembly with locking ring, $297,920.

Gear Grinding Machine Co., Detroit, repair kits, front axle universal joint, $138,986.

Continental Motors Corp., Detroit, engine assembly, $99,204; drawings and parts, $83,632.

Gar Wood Industries, Inc., Wayne, Mich., gears, cane, shaft, $25,079; lever, shaft, arm, hub assembly, cylinder, sprocket, rod, etc., $215,614; tubes, pins, sheaves, misc. winches, bearings etc., $181,409.

Active Gear Co., Inc., Chicago, gears, mainshaft, collar, countershaft, $206,272.

Homelite Corp., Port Chester, N. Y., cylinders, with liner and studs, cleaner, air intake, $136,462.

Ward LaFrance Truck Corp., Elmira, N. Y., plugs, races (axle), oil seal, shims, etc., $216,165; joint, slip, rear axle prop, $47,829.

Federal Telephone & Radio Corp., Clifton, N. J., radios, $5,000,000.

Burgess Battery Co., Freeport, Ill., low temperature batteries, $339,458.

Espey Mfg. Co., Inc., New York, mod. kit for SCR 619, $166,539.

Narragansett Wire Co., Pawtucket, R. I., wire, $288,350.

Rome Cable Corp., Rome, N. Y., wire, $399,330.

Cleaver-Brooks Co., Milwaukee, mobile field bath units, $1,134,960.

International Register Co., Chicago, gun parts, $137,212.

Electric Auto-Lite Co., Toledo, distributor pins, $175,245.

Eidal Mfg. Co., Albuquerque, N. M., body holster, $328,153.

Westinghouse Electric Corp., Washington, D. C., electric drinking water coolers, $218,000.

Hercules Food Service, Brooklyn, N. Y., coffee urns, $187,014.

Congo Engr. Works, Mendota, Ill., drums, inflammable liquid, steel, $1,716,000.

Bowser, Inc., Ft. Wayne, Ind., pumps, gasoline dispensing, $172,050.

International Silver Co., Meriden, Conn., tableware, $176,351.

Stanley Works, New Britain, Conn., flat steel strapping, $161,276.

Blakeslee Co., Chicago, vertical mixing machines, $210,018.

Doehler Metal Furniture Co., New York, desk quarters, flat top, $537,046.

Ohio Steel Foundry Co., Lima, Ohio, castings for breech ring for 90mm gun T119, $468,272.

Sandy Hill Iron & Brass Works, Hudson Falls, N. Y., evacuators for 76mm guns, $231,397.

Superior Mfg. Co., Fitchburg, Mass., pinions, clev, rear sight, $525,000.

Phalo Plastic Corp., Worcester, Mass., wire, $390,795.

Chatham Electronics Corp., Newark, N. J., tubes, electron, $251,400.

Raytheon Mfg. Co., Waltham, Mass., tubes, magnetron, $216,045; radio sets, $400,000.

Chicago Industrial Instrument Co., Chicago, multimeters, $137,479.

Simpson Electric Co. Div., American Gage & Machine Co., Chicago, Phase III Industrial Preparedness Study for electrical indicating instruments, $254,554.

Hallicrafters Co., Chicago, radio sets, $3,491,530.

John R. Hollingsworth Corp., Clifton Heights, Pa., power units, $402,804.

United States Wire & Cable Corp., Newark, N. J., wire, $477,482.

Kropp Forge Co., Chicago, machine tools & equipment, $1,314,280.

Bay Engine & Parts Co., San Francisco, washer; cover; crankcase; water pump; plate; lever; camshaft; pulley, bearing, $108,147.

Universal Products, Inc., Dearborn, Mich., yoke, propeller, $155,260.

Lyon Metal Products, Inc., Aurora, Ill., steel boxes, tool & spare parts, $126,382.

E. W. Ferry Screw Products, Brookpart (Berea), Ohio, bolts, hexagon head, $150,045.

Buffalo Bolt Co. Div., Buffalo Eclipse Corp., N. Tonawanda, N. Y., bolts, hexagon head, $153,419.

Diamond T Motor Car Co., Chicago, generator assemblies, $124,600.

Magnesium Supply Low; 6 Plants Reopened

NEW YORK—Concern about future supplies of magnesium was a predominate feature of the 6th annual meeting of the Magnesium Association held here Nov. 9 and 10. Present demand is about 20% above the supply of 4 million lb a month.

By early next year it is expected that military demands will exceed the entire present output. Six reserve plants being reactivated will increase output to 20 million lb a month. If this goes entirely to stockpiling consumer use will be out entirely. If divided between stockpiling and military demands, the increasing consumer requirements can be at least partially met by the present privately owned Freeport (Texas) plant.

The association passed a resolution calling upon government agencies concerned to reactivate the plants as rapidly as possible and to divide the output between stockpiling and current military needs.

This year for the first time the consumption of wrought magnesium has exceeded castings. This trend is expected to continue in both commercial and military applications. E. S. Christiansen, president of Magnesium Co. of America, predicted a commercial demand of 75 million lb in 1951 and 102 million lb in 1952. This year the commercial consumption was 43 million lb.

A. W. Winston, Dow Chemical Co., was reelected president; W. C. Murray, Utica Radiator Corp., was elected vice president; and Otis Grant, Superior Bearing Bronze Co., was elected treasurer.

A NEW $2-MILLION PLANT in Cleveland was opened recently by Tinnerman Products, Inc., increasing production facilities more than 50%. Many types of Tinnerman "Speed-Nut" brand fasteners are produced on these four-slide presses in the new plant. In the plant's straight-line production arrangement, steel is received in a service wing on the east side of the building, routed directly to production rooms, and moved steady north through heat treating and shipping to loading dock at the rear of the plant

To Boost Truck Output

MELBOURNE (McGraw-Hill World News)—International Harvester Co. will step up its Australian truck production 20 a day when a new $2.25-million plant is completed at Dandenong, Victoria. The first Australian truck ever made rolled off IHC's assembly line in August. Castings will come from the Geelong plant.

Industries Get Major Metalworking Contracts

NAVY

Permoflux Corp., Chicago, headsets, headband type, low impedance, $105,190.

Okonite Co., Passaic, N. J., cable, lighting & power 600 volts max., $119,646.

Collyer Insulated Wire Co., Pawtucket, R. I., cable, lighting & power 600 volts max., $147,983.

Phelps Dodge Copper Prod. Corp., Habirshaw Cable & Wire Div., New York, cable, lighting & power, non-flexing service types, $103,629.

Gill Electric Mfg. Corp., Redlands, Calif., aeronautic storage batteries, shielded, $923,283.

Willard Storage Battery Co., Cleveland, caps, vent, for batteries, $431,101.

Bendix Aviation Corp., Eclipse Pioneer Div., Teterboro, N. J., alterators & excitor controls for aircraft, $152,376.

U. S. Thermo Control Co., Minneapolis, refrigerators, $166,085.

General Motors Corp., Harrison Radiator Div., Lockport, N. Y., repair parts for radiators and coolers, $258,796; **Cleveland Diesel Engine Div.**, repair parts for diesel engines, $372,716; **Electro-Motive Div.**, repair parts for diesel engines, $152,306.

Time Facsimile Corp., New York, facsimile recorders, $300,000.

National Co., Inc., Malden, Mass., frequency shift keyers, $450,000.

Combustion Eng. Superheater, Inc., New York, boilers, $250,000.

Harvick Mfg. Co., Lynwood, Calif., aluminum hand trucks, $111,582.

Pennsylvania Smelting & Refining Co., Philadelphia, services & facilities for conversion battery lead scrap, $100,075.

Ohio Galvanizing & Mfg. Co., Niles, Ohio, trailers, warehouse, $255,422.

O. G. Kelley Co., Dorchester, Mass., ration containers, abandon ship, $232,130.

Ingersoll Mfg. Corp., Indianapolis, Ind., crawler cranes & equip., $101,753.

Bay City Shovels, Inc., Bay City, Mich., crawler cranes & equipment, $300,500.

AIR FORCE

North American Aviation, Inc., Los Angeles, misc. assemblies and sub-assemblies, spare parts for F-51, F-82, F-86, T-6, T-28, B-25 and B-45 aircraft, $10,785,746.

Douglas Aircraft Co., Inc., Santa Monica, Calif., spare parts for B-26, C-74 and C-124 aircraft, $2,810,000.

Fairchild Aircraft Div., Fairchild Engine & Airplane Corp., Hagerstown, Md., modification of two model C-119 airplanes, handbooks, and drawings, $500,000; misc. assemblies, subassemblies, spare parts for aircraft, $2,205,463.

Canadian Commercial Corp., Montreal, spare parts for C-47 and C-54 aircraft, $1,387,488.

Lockheed Aircraft Corp., Burbank, Calif., misc. spare parts for F-80, T-33, and F-94 aircraft, $3,850,202.

Bendix Aviation Corp.: Eclipse-Pioneer Div., transmitters, fuel flows, $147,836, and components of auto pilots, $229,070; **Bendix Radio Div.**, components of radio compasses, $500,354; **Scintilla Magneto Div.**, overhaul & maintenance, spare parts & sub-assemblies, for ignition equipment, $274,705, and exciter units, dynamotor and filter units, $306,897; **Bendix Products Div.**, misc. spare parts, $179,307, and carburetor spare parts, $387,663.

Mechanical Products, Inc., Jackson, Mich., items of circuit breakers, $193,725.

Craig Machine, Inc., Denvers, Mass., shelter, $302,052.

Bell Aircraft Co., Niagara Falls, N. Y., misc. spare parts for aircraft, $250,000.

Saval, Inc., Los Angeles, valves, $139,173.

Mine Safety Appliances, Pittsburg, oxygen masks, $307,900.

Aeroquip, Corp., Jashron, Mich., fitting assemblies, hydraulic, $104,445.

B. F. Goodrich Co., Akron, Ohio, misc. deicer shoes for B-25, $340,415.

Alar Products, Inc., Cleveland, rework govt. furnished oxygen regulators, $196,350.

Permutit Co., New York, seawater desalting kits, $147,800.

Beech Aircraft Corp., Wichita, Kan., navigators observing domes, $142,730.

Allied Aircraft Co., North Hollywood, Calif., magnetos, $172,468.

Goodyear Tire & Rubber Co., Akron, Ohio, maintenance parts for wheel & brake assemblies, $196,156.

Revere Copper & Brass, Inc., Detroit, aluminum alloy tubing, $185,369.

Wittek Mfg. Co., Chicago, hose clamps, $267,774.

Barden Corp., Danbury, Conn., ball bearings, $527,085.

Lycoming-Spencer Div., Avco Mfg. Corp., Williamsport, Pa., spare parts for V-1650 engines, $1,885,974; power plants, $9,680,619.

General Electric Co., Schenectady, N. Y., type BH-4 turbos, spare parts, $4,410,338.

Collins Radio Co., Cedar Rapids, Iowa, communication receiver transmitter, $102,622.

Wright Aeronautical Corp., Curtiss-Wright Corp., Wood-Ridge, N. J., spare parts for R-3350 aircraft engines, $5,040,000.

SKF Industries, Inc., Philadelphia, roller bearings, $101,000.

Marlin-Rockwell Corp., Jamestown, N. Y., roller bearings, $272,300.

Emerson Electric Co., St. Louis, Mo., fans, air circulating, $630,060.

Denison Engineering Co., Columbus, Ohio, stand assembly, portable hydraulic, $126,400.

Keco Industries, Inc., Cincinnati, coolers, portable, $176,472.

JOINT MEDICAL PROCUREMENT

Wilmot Castle Co., Rochester, N. Y., dental operating lamps, $114,367.

S. Blickman, Inc., Weehawken, N. J., instrument & dressing cabinets, $133,717; combination type medicine cabinets, $177,504.

Ohio Mechanical & Surgical Instrument Co., Div. of Air Reduction Co., Inc., Madison, Wis., sterilizers, $247,834.

Richard H. DeMott

Thomas R. Hughes

Robert G. Van Keuren

O. F. Heslar

Names in the News

Richard H. DeMott has been named president of SKF Industries, Inc., Philadelphia, succeeding **William L. Batt,** who resigned to become chief of the ECA mission to England. Mr. DeMott, who has been vice president in charge of sales since 1943, joined SKF in 1915. He became district manager of the New York sales office in 1916, set up a department of industrial development in 1921, became assistant sales manager in 1923, and general sales manager in 1928. **Stuart H. Smith** has been named manager of industrial development and **John H. Tipton** has been named Cincinnati district manager of SKF. **Emerson D. Ogle,** manager of the industry division, was named assistant district manager at Cincinnati and **B. K. Lathbury,** industry section supervisor, was named assistant manager of industrial development.

J. M. Schiavetti has been named vice president in charge of production, Gerotor May Corp., Baltimore. Formerly purchasing agent, he has been in charge of manufacturing since 1948.

Willard F. Rockwell, chairman of Rockwell Mfg. Co., Pittsburgh, has been elected to the board of E. W. Bliss Co., Canton, Ohio. He succeeds his brother, **Walter Rockwell,** president of Timken-Detroit Axle Co., who has resigned from the Bliss board. **Lucien R. Collart** has been elected secretary and treasurer of Bliss, succeeding **E. S. McClary,** who died Sept. 23, 1950.

Walter Donnelly has been named works manager, Tomkins-Johnson Co., Jackson, Mich. He was formerly with Sterling Engine Works, Buffalo.

Thomas R. Hughes has been named vice president and sales manager of Utica Drop Forge & Tool Corp., Utica, N. Y. He joined the firm in 1940 as a production control man.

Robert G. Van Keuren has been named chief sales engineer, Abrasive Div., Norton Co., Worcester, Mass. He succeeds **A. Oakleigh Bush** who died Sept. 2. Since 1945 Mr. Van Keuren has been a section head in the Sales Engineering Dept.

H. E. Hasemeyer has been named assistant production manager, Electric Auto-Lite Co., Toledo. He has been manager of the Stickney Avenue plant in Toledo, where he is succeeded by **Irwin B. Hayes.**

Carl F. Herbold has been named director of manufacturing planning, Westinghouse Electric Corps.' Small Motor Div. at Lima, Ohio. Formerly manager of industrial relations at the Small Motor plant, Mr. Herbold is succeeded in that position by **K. H. Smith. J. M. Wallace** has been named manager, Switchgear Distribution Apparatus Dept., Pittsburgh. **H. H. Fahnoe,** formerly in charge of engineering development on fuses, cutouts, and reclosers, succeeds Mr. Wallace as engineering manager of the department. **L. R. Ludwig** has been named assistant to the vice president of industrial products. He was formerly manager of the Motor & Control Division, Buffalo. **William C. Lilliendahl** has been named research advisory engineer for the Lamp Div., Bloomfield, N. J., where he will direct the metals section of the research department. **E. C. Hanks** has been named sales manager, Gearing Div., Pittsburgh.

O. F. Heslar has been elected executive vice president of E. C. Atkins & Co., Indianapolis, and **J. G. Martin** has been elected assistant secretary-treasurer, continuing also as credit manager. Mr. Heslar, who recently joined Atkins, is a retired Navy captain, and was formerly director of public works and supply of the State of Indiana.

Charles Pack, formerly vice president in charge of production, Doehler-Jarvis Corp., has been named vice president in charge of the newly formed Engineering & Research Dept. **W. G. Gutmueller,** formerly vice president and secretary, has been named vice president and production manager. **Louis Miller,** director of labor relations, was named assistant vice president. **Harold L. Samuels** has been named secretary and **H. C. Mandeville,** assistant secretary.

S. R. Marshall has been named director of purchases, Hydraulic Equipment Co., Cleveland. He was previously associated with Joy Mfg. Co.'s Cleveland Division and with Plymouth Div., Chrysler Corp.

Shannon C. Powers has been named general sales manager of Russell Electric Co., Chicago subsidiary of Raytheon Mfg. Co.

John A. Decker has been named sales manager, New York district, Carborundum Co., Niagara Falls, N. Y. **William J. Kingsley** has been named assistant sales manager of the Bonded Products & Grain Div., at Niagara Falls. **Thomas Curtiss,** field sales representative at Buffalo, has moved to the central New York area. **Edgar T. Harris** succeeds Mr. Curtiss at Buffalo. **George Dennison** has been named special sales engineering representative for New York State, working out of Buffalo.

E. Claude Jeter has been named manager of Ford Motor Co.'s new production foundry under construction at Cleveland. **Harry G. McMurry** has been named manager of the Dearborn Iron Foundry, succeeding Mr. Jeter, former plant manager. The managers of each foundry will function under **Charles H. Patterson,** production manager of Automotive Manufacturing Operations.

Edward D. Rollert has been named assistant to the general manager of the Buick-Oldsmobile-Pontiac Assembly Div. to handle special defense assignments. He has been administrative assistant to the general manager, New Departure Div., Bristol, Conn., for the past two years.

Thomas I. Burbage has been elected secretary of Black & Decker Mfg. Co., Towson, Md., to succeed the late **Harry G. Wheeler.** He has been serving as assistant to the vice president in charge of manufacturing.

Lawrence H. Russell has been named sales manager, Walker-Turner Div., Kearney & Trecker Corp., Plainfield, N. J. He served three years as sales manager, Power King Div., Atlas Press Co.

W. C. Heath, formerly chief engineer, Solar Aircraft Co., San Diego, has been named head of the new Aircraft Products Dept., and **Paul A. Pitt** will direct the Development Engineering Dept. following division of the Engineering Dept. to handle the heavier work load from defense orders. **W. B. Gurney** and **P. L. Ward** will assist Mr. Pitt.

Robert J. Minshall, president, Pesco Products Div., Borg-Warner Corp., Chicago, has been given the additional assignment of vice president and general manager of Marvel-Schebler Carburetor Div. **S. W. Gray** will continue in the presidency of Marvel-Schebler, as a consultant on sales policy. The division has been transferred from Flint, Mich., to a new plant in Decatur, Ill. The company's name is to be changed to Marvel-Schebler Products Div.

Harry J. Swanson has formed his own machine tool sales firm, Swanson Machinery Corp., Grand Rapids, Mich. He recently resigned from E. L. Essley Machinery Co., Chicago, after ten years as district manager for sales in western Michigan and northern Indiana.

I. L. Wallace, formerly superintendent, Carbide Metal Div., Carboloy Co., Inc., has been named manager of engineering for carbide and other special metals. **J. A. Muldoon** has been named manager of manufacturing. He was superintendent of the Carbide Fabricating Div. **R. L. Brownlee,** formerly production manager on carbides will now also include other special metals. **S. B. Strom** has been named comptroller. Since 1943 he has been assistant to the president.

John A. Maxwell, Jr., has been named works manager, Texas Engineering & Mfg. Co., Inc., Dallas. He was formerly administrative assistant to the president. **Otto Witbeck,** formerly general superintendent, was named factory manager. Other appointments: **J. C. McKelvain,** director of quality control; **C. D. Collier,** director of materiel.

Grant J. Casserly and **David R. Falvey** have been named field engineers, Allison Co., Bridgeport, Conn., for the recently combined territories of New England and northeastern New York State.

James F. Brehm has been elected president of Frederick Hart & Co., Inc., Poughkeepsie, N. Y., electrical and electronic equipment subsidiary of ATF Inc. Mr. Brehm joined the Hart company in 1949 as vice president.

C. S. Allen has been named general manager, Star-Kimble Motor Div. of Miehle Printing Press & Mfg. Co., Bloomfield, N. J. He was with A. O. Smith Electrical Mfg. Co., Los Angeles, as vice president and general manager. Previously, he was with General Electric Co. for 16 years.

P. J. Gallagher has been named general sales manager of Hinderliter Tool Co. Div., H. K. Porter Co., Inc., Tulsa, Okla.

Sherman S. Cross has been named operations manager, Brainard Steel Co., Warren, Ohio, succeeding **J. Howard Patton,** resigned. Mr. Cross joined Brainard in 1949 as chief product engineer.

Herbert Ashcroft, Jr., has been named staff industrial engineer, Bausch & Lomb Optical Co., Rochester, N. Y. He was formerly in charge of manufacturing operations at New Jersey Optical Co., Irvington, N. J.

Obituaries

Lewis J. Firth

Lewis John Firth, 92, president of Firth Sterling Steel Co. until 1937 and then chairman until 1944, died Nov. 3. He joined Thos. Firth & Sons, Ltd., Sheffield, England, in 1858, eventually becoming managing director. When Firth acquired Sterling Steel Co., McKeesport, Pa., he became the first president of the new firm, Firth Sterling, in 1897. Under his guidance the company was one of the first makers of high-speed tool steel and made the first stainless steel in this country.

William D. Loughlin, 57, chairman of Boonton Radio Corp., Boonton, N. J., died Nov. 12. He became president of Radio Frequency Laboratories at Boonton in 1931, and in 1934 formed Boonton Radio Corp.

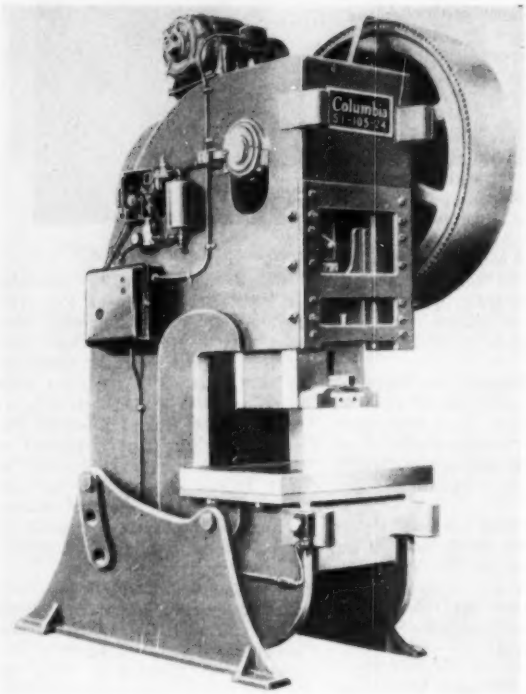
Chester A. Orr, 67, board chairman of Union Metal Mfg. Co., Canton, Ohio, died Oct. 10.

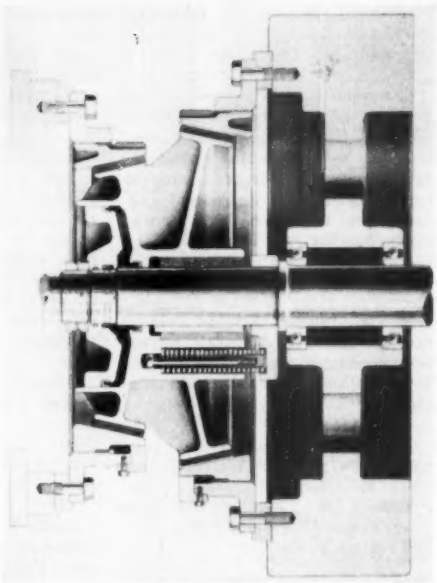
Allan C. Davidson, 59, secretary-treasurer of Niles Rolling Mill Co., Niles, Ohio, died Oct. 13.

S. S. Inch, general sales manager of Kaiser Aluminum & Chemical Corp., has been named vice president in charge of sales. **Thomas J. Ready, Jr.,** assistant general manager, has been named vice president, and **Donald E. Browne,** formerly controller, was named vice president and treasurer. **Russell A. Clayton** was named controller.

George P. Maurer has been named assistant chief engineer, gear technology, Falk Corp., Milwaukee. **W. Stephen Richardson** has been named assistant chief engineer, applications & special products, and **Edward J. Wellauer** was named assistant chief engineer, materials and research.

New Shop Equipment





Section of aluminum clutch showing 12°-cone construction. Used on the 60 ton and larger sizes

Single-crank open-back inclinable press, capacities 60 tons and larger. May be inclined a maximum of 25° from the vertical

Aluminum Cone Clutch Put In Press Line

Columbia has developed a complete line of single-crank open-back inclinable and gap presses. The line includes OBI presses in a complete range of sizes from 10 to 200 tons capacity, and gap presses in capacities from 60 to 200 tons. Two basic designs are used; one for presses up to 45 tons capacity, and a heavier, more rugged design for larger units.

The smaller presses use a cone clutch which is lighter and more compact than friction-disk clutches formerly employed. Location of the clutch on the crankshaft allows the flywheel to be placed outside the housing and permits use of a smaller bull gear, giving more room for die setup and operation. With this construction, a different group of gear teeth engage at each stroke, eliminating excessive wear on a few teeth.

The larger sizes use a patented aluminum cone clutch which is said to be greatly reduced in size and weight and with a correspondingly large reduction in flywheel effect. The aluminum parts are claimed to quickly dissipate heat and, as the clutch and brake linings are fastened to inner members, heat generated is thrown outward and more quickly conducted away.

All models are V-belt driven with motor mount, motor sheave and V-belts furnished as standard equipment. Arrangement is made for pushbutton control on all models, although smaller units are regularly furnished with mechanically operated air valve incorporating a single-stroke device. All presses are of all-welded rolled-steel construction with cast-iron slides and extra-long- gibways.

Columbia Machinery and Engineering Corp., Hamilton, Ohio

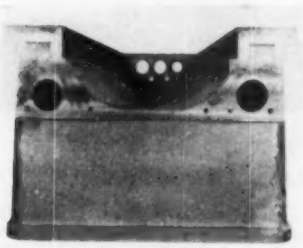
(MORE DATA? CIRCLE FYI 31, p. 157)

Snap-action switch features one-way "momentary action." It completes the circuit for a small, pre-determined part of the plunger's forward stroke; then gives release to the impulse as the plunger advances. No further action results for the remainder of the plunger's over-travel nor on the return stroke. The switch is single-pole, double throw.

Electro-Snap Switch Div., The Exhibit Supply Co., 4218-36 W. Lake St., Chicago, Ill.

(MORE DATA? CIRCLE FYI 32, p. 157)

Materials and Parts



Way mounting using dowels to lock the ways to the machine bed

Heat penetration on bedways is shown by metal discoloration. Hardness provides freedom from wear and galling

Hardened and Ground Ways on G & L Horizontal-Boring Machines

Heavy-duty, surface-hardened ways are available on horizontal boring, drilling, and milling machines. This structural feature is claimed to insure continuous machining accuracy over extended periods of time.

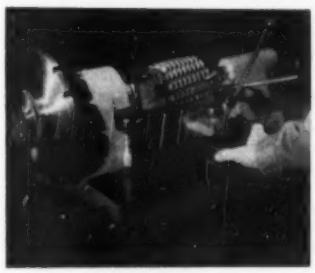
Physical characteristics of the ways are the result of progressive heat-treating practice, which is claimed to produce an unusual depth of hardness. During the operation, ways are held in a special fixture which duplicates the actual mounting surface used on the machining component. This fixture, coupled with a rapid-heating cycle, prevents way distortion. Heating and quenching are uniform throughout the way, and both are performed in a single pass on the machine. After hardening, the ways are precision ground.

An improved method of way mounting is claimed to minimize transmittal to the ways of torque strains and stresses set up by temperature changes. A tongue on the mounting surface of the machine bed, saddle or runway, slip-fits into a channel on the under surface of the way. The way, however, actually rests on broad handscraped shoulders located on either side of the tongue which forms an integral part of the basic machine casting. The way is locked in place on a mounting surface by double dowel pins, inserted through the way and into the casting tongue from both sides.

The ways are available on the bed, saddle, column, and runway. The line includes floor, table and planer type machines in a broad range of sizes.

Giddings and Lewis Machine Tool Co., Fond du Lac, Wis.

(MORE DATA? CIRCLE FYI 33, p. 157)



Hob-Sharpening Checker Measures Errors in Face Elements

This instrument inspects hobs and cutters for radialism, flute-to-flute spacing, total spacing, face offset, and accuracy of straight flutes with the axis. It may also be used for checking runout of faces and outside diameters of hubs as well as the OD-runout of the hob or cutter itself.

Designed to utilize the standard index plates of the company's No. 10-12 hob-sharpening machine. These plates are 9½ in. in diameter and index is held to plus or minus 0.0005 in. adjacent and plus or minus 0.0015-in. total error.

Barber-Colman Co., Rockford, Ill.

(MORE DATA? CIRCLE FYI 34, p. 157)

... INCLUDING

Mechanical presses, one a long-stroke model, the other a deep-throated press, feature convenience of operation.....page 150

Pre-assembled nut and lock washer cuts assembly time, simplifies quality control..page 151

Die-casting machine is automatic in operation, has infinitely variable cycling speed.....page 152

Vertical milling machine has 10 spindle speeds in a range from 180 to 2500 rpm.....page 152

Cutter and radius grinder has simplicity of design which makes it quick to set up.....page 160

Induction heater puts gears through an automatic cycle for hardening .....page 164

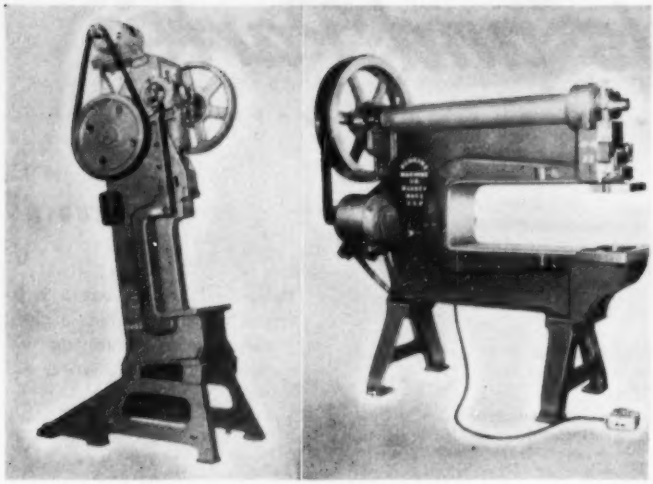
Spot welder, portable, requires one hand to operate by resting tong on welding spot....page 166

NEW BULLETINS for your Shop Library, including a 44-page bulletin covering hydraulic fluids, systems.....pages 157 and 158

... and in December 11

Gear tester checks low-planet pinions for nicks by running them in mesh with a master gear.

Spot welder tailors the shape of the welding current to conform with the nature of the material being fabricated.

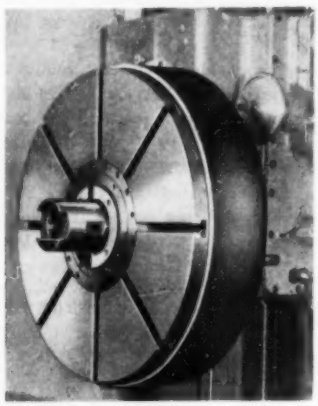


Perkins Presses Designed For Convenience of Operation

The Model 201-S long-stroke press has an effective stroke of 7 in. and throat clearance from bed to ways of 21 in. It is designed for easier and faster changing of dies. The column is tilted back for more convenient operation. Has back gear drive powered by a 1-hp. motor.

The Model 10-M-32 is a deep-throated press designed for higher production on a wide variety of work where extra throat capacity is required. Its accessibility to all moving parts and to dies make it economical to operate. Has flywheel drive powered by 1½-hp. motor.

Perkins Machine Co., Warren, Mass.
(MORE DATA? CIRCLE FYI 35, p. 157)



G & L Faceplate Drive Provides 4 to 1 Speed Reduction

Tools, tool heads and special tooling setups can be rigidly mounted on this faceplate, or it may be employed for holding and rotating the workpiece while tools are mounted on the machine table and fed by the table movements. The plate is 30 in. in diameter and equipped with 8 radial T-slots on its working surface.

Mounted permanently on the headstock, the faceplate drive is engaged or disengaged by means of a built-in clutch mechanism. This is operated by shifting a simple hand crank on the back of the unit. The main spindle and the spindle sleeve extend through a hole in the center, permitting the spindle to be used interchangeably with the faceplate drive. The spindle is retracted in its sleeve when not in use.

The faceplate is driven from the power or back-gear shaft of the machine. A pinion on the end of the shaft drives an internal ring-gear located inside the drum housing. If the machine is equipped with an auxiliary high-speed spindle, this is disengaged and retracted when the faceplate drive unit is being mounted on the headstock. The drive is for G & L horizontal boring, drilling and milling machines.

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
(MORE DATA? CIRCLE FYI 36, p. 157)

Lift Truck Has Two Speeds Among Other Improvements

The Load-Mobile electric lift truck has the following improvement. A high-low switch is provided for easier maneuverability in close quarters. When the button is at low, the truck moves at slow speed regardless of the position of the operating pedal. When the button is at high, the operator controls the speed; either high or low by means of the pedal.

Other improvements are spring-mounted casters, and freer use of sealed ball bearings in the control system to ease pedal operation. A heavy roller chain operates the brake instead of an enclosed cable. The hydraulic lifting mechanism is arranged in a vertical position at the front end of the hood where it is less likely to be damaged in transit over rough floors.

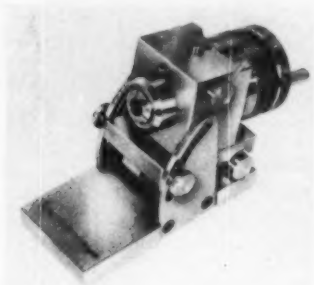
Market Forge Co., Everett, Mas.
(MORE DATA? CIRCLE FYI 37, p. 157)

Hand Power Tool and Accessories Kit Have Many Uses

Balanced and shaped to fit the hand, the Handee '85 has an idling speed of 27,000 rpm and a load speed of 20,000 rpm. It weighs two pounds and chucks interchangeable spring collets of 1/16, 3/32, and ⅛ in. capacity.

A cast-in boss, just behind the chuck, holds easily-attached routing and molding shoes. Forty-one matched attachments have been assembled into one case, called the Handee Workshop, as a companion for the tool.

Chicago Wheel & Mfg. Co., 1101 West Monroe Street, Chicago 7, Ill.
(MORE DATA? CIRCLE FYI 38, p. 157)



Starco Grinding Attachment Allows Rapid Taper Setup

The Starco grinding attachment embodies four features which are claimed to contribute to maximum savings in setups: a sine plate held to within 0.0001 in. allows rapid setups for tapers; 12 positive stops held to within one minute permit rapid indexing of common divisions; for odd angles, a finely cut dividing head and vernier provides settings for any angle within 2½ min.; the unit itself, hardened and ground square with the spindle, eliminates the use of indicators in setting up.

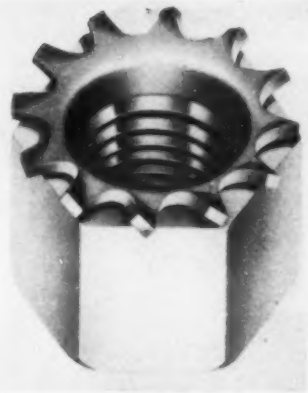
Star Gage Co. Inc., 261 Oak Grove Ave., Springfield, Mass.
(MORE DATA? CIRCLE FYI 39, p. 157)

Pure Tungsten Electrodes For Inert-Gas Arc Welding

Pure tungsten electrodes, having a melting point of about 6000 F, suitable for atomic-hydrogen and gas-shielded electric-arc welding of a wide range of metals have been developed by Sylvania.

The use of tungsten electrodes in inert gas atmospheres, according to Beatty, prevents the formation of oxides, nitrides, and other contaminants which tend to reduce the strength of welds. Since tungsten has the lowest vapor-pressure property of any metal the amount of the electrode consumed is held at a minimum.

Tungsten & Chemical Div., Sylvania Electric Products, Inc., Towanda, Pa.
(MORE DATA? CIRCLE FYI 40, p. 157)



For American Standard light nuts, the lockwasher is pressed against a flange, yet is free to rotate

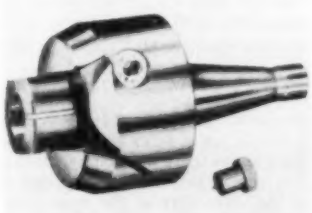
For American Standard machine-screw nuts and AS regular nuts, the lockwasher is pressed into a groove

Pre-Assembled Nut and Lock Washer Cuts Handling Time

These units, known as Keps, are handled as one to eliminate many costly hand operations. They are said to have the following additional advantages: easier to start because of a funneling action due to the greater ID of the washer; material waste in the form of lost lockwashers is eliminated; quality-control procedures are simplified because lock washers cannot be omitted at assembly; every lockwasher applied is of the proper size, material, and finish.

The units are furnished with a standard thread length. The washer is a Shakeproof design, providing a greater bearing area. The strut action of each tapered twisted tooth is claimed to positively resist loosening. The units available in American Standard light nuts (semi-finished hexagon steel) American Standard machine-screw nuts (hexagon steel) and American Standard regular nuts (semi-finished hexagon steel).

Shakeproof, Inc., 2501 N. Keeler Ave., Chicago 39, Ill.
(MORE DATA? CIRCLE FYI 41, p. 157)



Everede Offset Boring Head Produced for Intermediate Sizes

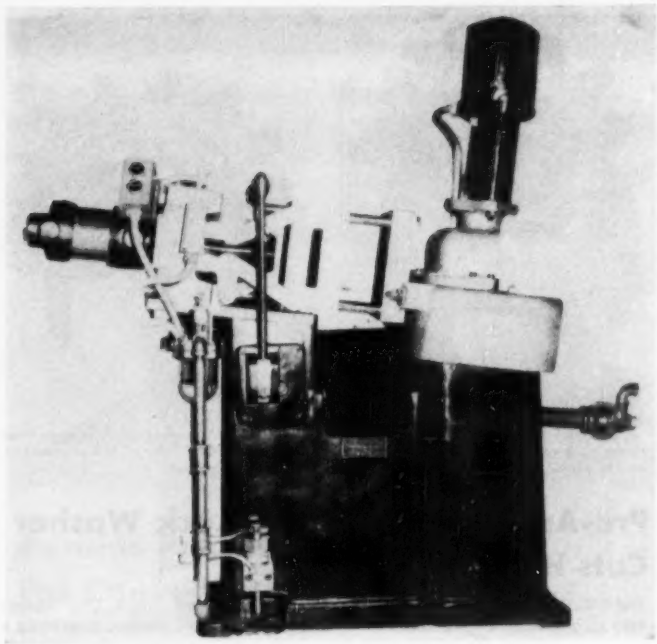
Boring head supplements the other sizes being manufactured by Everede tool. It is 3 11/16 in. in diameter and has a maximum boring capacity of 4½ in. When equipped with an extension attachment, it is possible to increase this capacity 100%. Known as the No. 3-50, it can be used in popular size vertical mills, jig-boring machines, and turret lathes.

Everede Tool Co., 2000 N. Parkside Ave., Chicago 39, Ill.
(MORE DATA? CIRCLE FYI 56, p. 157)

G-S Protective Masks Have Replaceable Laminated Filters

G-S protective masks consist of an aluminum shield, which is held in position by an adjustable elastic head band, and replaceable laminated filters of extra thickness. They protect throat, nose and bronchial tubes from particles of non-toxic dust. Because of the simplicity of their design, the masks are said to be cool and comfortable. The masks weigh less than ½ oz., hence are light to wear. Price—30 cents.

General Scientific Co., 2700 W. Huntington St., Philadelphia 32, Pa.
(MORE DATA? CIRCLE FYI 42, p. 157)



High-Speed Die-Casting Machine Is Fully Automatic in Operation

This Model FA17 machine is identical with the previous model A16A, with the exception of fully automatic controls. Maximum capacity is 1 lb., die blocks used are 9x9x2½ in.

Automatic cycling speeds are infinitely variable from 0 to 3000 shots per hour. Cycles are as follows: Die closes. Final overlock of toggle lock releases mechanical safety valve on bottom link and top link actuates solenoid, activating piston down stroke. An infinitely variable timer holds down the piston for the desired length of time, then releases air to piston upstroke, setting off second timer which permits variable dwell. Completion of dwell-time cycle activates solenoid controlling die-unit cylinder, which opens die and ejects casting. Opening of die activates solenoid attached to side of back block, which starts cycle again.

DCMT Sales Corp., 164 Duane St., New York 13, N. Y.

(MORE DATA? CIRCLE FYI 43, p. 157)

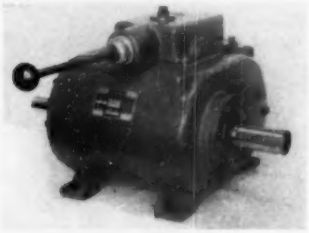
Accumulator, Quick-Release Valve Build Up Great Force in Air Motor

The Super Speed air motor is a double-acting air cylinder said to develop great piston-rod speed and power from normal operating air pressure. Utilizing a built-in air accumulator and quick-release valve, it builds up a force claimed to be many times more powerful than that obtained from standard air motors of the same bore at the same pressure. The power developed depends on the pressure applied and the load in pounds on the end of the piston rod.

The motors have the integral direction valve with built-in operating and speed controls characteristic of all of the company's motors. They are made in two bore sizes, 2½ and 3⅝ in., equipped with either manually-operated valve or with the Electro-aire valve for synchronized electrical control. Standard stroke lengths are 4, 6, 9, and 12-in. for both sizes. Special stroke lengths available on order.

The Bellows Co., 222 W. Market St., Akron, Ohio.

(MORE DATA? CIRCLE FYI 44, p. 157)



Western Transmission Has 5 to 1 Over-all Speed Ratio

Model-420 transmission has four speed changes in geometric progression of 1.7 to 1, with a 5 to 1 over-all ratio. The case is large enough to accommodate special ratios up to 9 to 1.

All gears and shafts are alloy steel, heat-treated, and with the gears shaved. The revolving shafts are mounted on anti-friction bearings and the case is oil-sealed.

Western Mfg. Co. 3400 Scotten Ave., Detroit 10, Mich.

(MORE DATA? CIRCLE FYI 45, p. 157)

Ten-Character Marking Done by Hand Stamp

Hand stamps are obtainable from stock with popular descriptive words, steel trade names, codes, serial numbers, fractions, etc. They come with 3/32-in.-high characters, are 3½-in. long, and are made up to a maximum of 10 characters per stamp, reading in one line.

Each stamp is marked on the front side and top for easy identification.

Quality Die Co., 9308 S. Baltimore Ave., Chicago 17, Ill.

(MORE DATA? CIRCLE FYI 46, p. 157)

3M Abrasives save time and labor by polishing flat sheets prior to forming and plating

Automotive manufacturers and suppliers have substantially reduced the cost of preparing metals for plating, with this new "pre-polishing" method. Flat sheets of steel are passed under a series of grinding and polishing heads where progressively finer grits of abrasive belts automatically produce surfaces conditioned for plating. These operations are being performed at speeds up to 40 feet per minute.

This means that pits, seams, slivers and other surface imperfections are removed while the steel is in sheet, coil, or blank . . . the most economical forms to handle.

Users report that "pre-polishing" minimizes die strain while cutting finishing and handling costs. If you manufacture products that require polishing before plating, it'll pay you to investigate this new development. Send for our bulletin on "pre-polishing" . . . see coupon on this page.

Send me your latest report on "pre-polishing"

AM-1150

Name_____

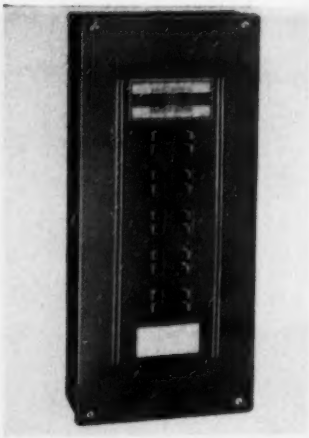
Department_____

Firm Name_____

Street Address_____

City_____ State_____

Made in U.S.A. by Minnesota Mining & Mfg. Co., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives. *General Export:* Durex Abrasives Corp., *New Rochelle N. Y. In Canada:* Canadian Durex Abrasives Ltd., *Brantford, Ontario.*



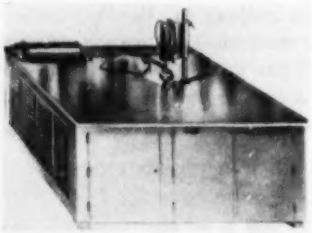
Square D Load Center Has Split Main Bus

The MO-20 multi-breaker load center has the bus segregated in order to allow the control of all lighting circuits by a main breaker while other heavier circuits are controlled by parallel main breakers. With this arrangement, it is said an economical 100-amp circuit-breaker service-entrance device is available complying with paragraphs 2351-A and 2371-A-3 of the 1947 National Electrical Code.

All circuits give two-way protection with a thermal-magnetic operating mechanism which is said to combine the advantages of both types of tripping elements.

Square D Co., 6060 Rivard St., Detroit 11, Mich.

(MORE DATA? CIRCLE FYI 47, p. 157)



Drawn-Shell Trimmer Handles Both Round and Irregular Pieces

Model-B machine will trim shells of practically any depth up to a maximum of 14 gage in thickness. A tooling adapter is provided for any size or shape shell, up to a maximum diameter of 12 in., making it possible to trim not only round shells, but irregular shells with a minimum of 1/16-in. internal radius. Only one external universal cutter is needed for all operations.

The work spindle is provided with a variable-speed drive, making it possible to trim shells, depending upon their size and shape, at a rate of 20 to 500 per hour. Operations such as beading, forming, flanging, and other second operations can be done with a minimum of special tooling. It is provided with a 3-hp. motor.

Dayton Rogers Mfg. Co., 2824 13th Ave. South, Minneapolis 7, Minn.

(MORE DATA? CIRCLE FYI 48, p. 157)

Boston Universal Joint Has High Static-Torque Rating

This joint is designed for high load-carrying capacity and high static torque rating. It equals or exceeds government specifications set up for aircraft (Army-Navy Class 1) and shipbuilding (Type A—Class A).

The yokes are heat-treated alloy steel with bearing surfaces precision ground and OD ground to plus 0.000 minus 0.001 for concentricity. Bearing pins and center bearing block are hardened and ground. A self-locking ring assures secure assembly and permits quick and easy disassembly. A self-closing, ball-valve oiler provides the lubrication.

Boston Gear Works, Quincy, Mass.

(MORE DATA? CIRCLE FYI 49, p. 157)

Coating for Aluminum Protects Metal from Corrosion

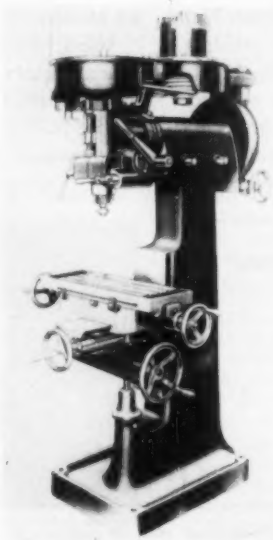
A process, called Pylumin, may accomplish two things. It can give an attractive coating with definite corrosion-resistance value if no paint finish is applied. In addition it provides an adhesive and efficient base for paint finishes. An immersion process, it employs a single powder whose ingredients have been proportioned and premixed. The solution is maintained by use of a test kit.

The costs of installation and operation are low. Ordinary heated steel tanks are all that is required. Unless there is an exceptional amount of grease and dirt on the part, no special cleansing is required.

Pyrene Mfg. Co., Metal Finishing Div., 10 Empire St., Newark 2, N. J.

(MORE DATA? CIRCLE FYI 50, p. 157)

Ova Vertical Milling Machine Has 10 Spindle Speeds



Over-all table dimensions	25¼x9¾ in.
Longitudinal hand table movement	12¾ in.
Cross table movement	8 in.
Vertical table movement	17¼ in.
Vertical hand feed of spindle	3½ in.
Max. distance spindle to column	13¾ in.
Number & range of Spindle speeds	10, range 180/2500 rpm

The C.V.A. No. 79 vertical milling and die-sinking machine is powered by a ¾-hp motor through a step-cone pulley and V-belt directly to the spindle. Pushbutton control is provided, and both coarse and fine feeds to spindle are available. The headstock swivels 90°, and there is a sliding adjustment of the spindle head, so that the machine can be used for a variety of jobs with simple tools and fixtures.

Provision is made on the headstock for a tracer arm. Motor is 220-volt, 3 phase, 60-cycle ac. Extra equipment available includes boring bars, collets, and circular tables.

DCMT Sales Corp., 164 Duane St., New York 13, N.Y.

(MORE DATA? CIRCLE FYI 51, p. 157)

Cut Costs To The Minimum

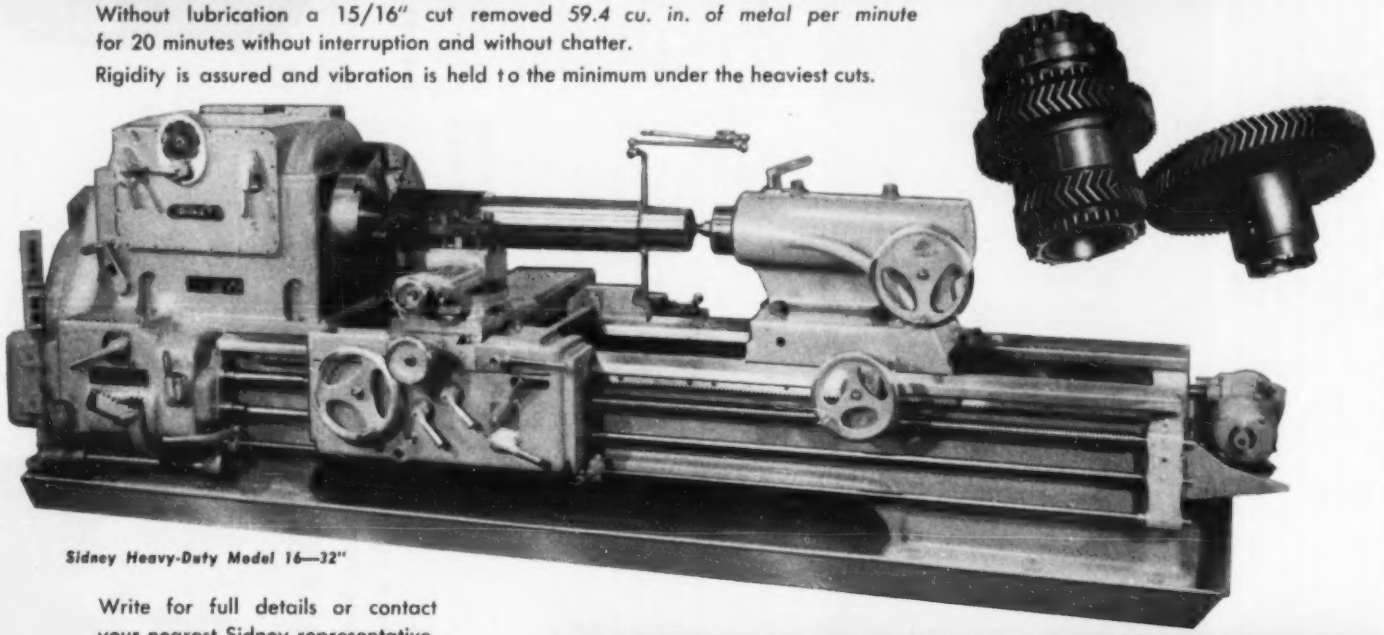
SIDNEY HEAVY-DUTY LATHES

"COST MISERS"

CARBIDE TOOLS CAN BE USED TO UTMOST EFFICIENCY

Without lubrication a 15/16" cut removed 59.4 cu. in. of metal per minute for 20 minutes without interruption and without chatter.

Rigidity is assured and vibration is held to the minimum under the heaviest cuts.



Sidney Heavy-Duty Model 16—32"

Write for full details or contact your nearest Sidney representative.

A SIDNEY LATHE IS THE FINEST TURNING TOOL EVER PRODUCED

SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO

BUILDERS OF PRECISION MACHINERY SINCE 1904

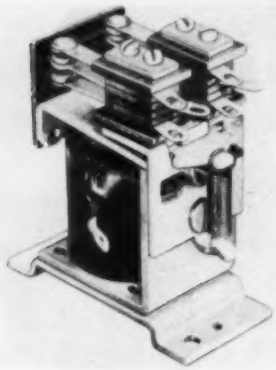
Arbor-Press Frame Made of Close-Grained Cast Iron

The Model HP-600 provides 800 lb. of pressure and the controls necessary for pressing small shafts, gears, wheels and bushings.

The frame, table, and table standard are close-grained iron castings. Base of frame has one-inch arbor opening and is finished to serve as an auxiliary table. Ram and pinion are special steel, and ram take-up is provided. Ram bearings in frame are carefully machined vertical to table. The table has three slots for arbor work, ¼-, ½-, and ¾-in. wide. The table and table standard may be removed to accommodate large work. A straightening attachment Type SA-601, is available. It is 4½-in. wide between V-supports.

H. D. Herder, 2723 E. Michigan Ave., Kalamazoo, Mich.

(MORE DATA? CIRCLE FYI 52, p. 157)



R-B-M General-Purpose Relays Offer Higher Contact Pressures

By adapting a longer frame and larger coil bobbin to its 97000 Series relays, R-B-M has developed a design offering higher contact pressures and more coil power. They are particularly suited for applications where unusual shock or vibration is encountered. It has the same panel-mounting space requirements and contact construction of the 98000.

R-B-M Division, Essex Wire Corp., Logansport, Ind.

(MORE DATA? CIRCLE FYI 53, p. 157)

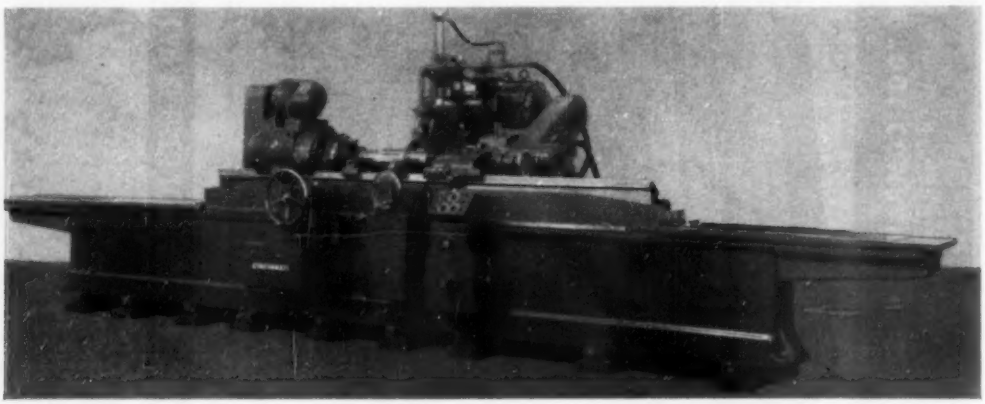
Hannifin Large-Diameter Cylinder For Air, Oil or Water Service

Cup-type pistons and chevron-gland packings make these large diameter cylinders suitable for air, oil, or water service. The end caps are furnished to the same mounting dimensions, either cushioned or non-cushioned. Two large pipe ports are drilled in each cap, 1 in. in the 14-in. bore size, 1¼ in. in the 16-in. size. Double-end rods are available.

Principal use is where large forces are required; the 16-in. cylinder will exert a force of ten tons on a push stroke at 100 psi. Capacity is 125 psi, air, or 160 psi, hydraulic.

Hannifin Corp., 1118 So. Kilbourn Ave., Chicago 24, Ill.

(MORE DATA? CIRCLE FYI 54, p. 157)



PLAIN-GRINDING MACHINES and traveling-table roll-grinding machines in three additional sizes have been added to the Filmatic line. The sizes are 16-in. heavy-duty and 20- and 24-in. plain grinders; and 16-in., 20-in. and 24-in. roll grinders. The name Filmatic refers to the grinding-wheel-spindle bearings. This construction consists of segments which are free to rock slightly in the housing bore, thereby admitting wedge-shaped oil films between them and the spindle journal diameter as rotation occurs. The wedge-shaped films build up to high pressures, supporting the spindle on oil. Plain machines are built in seven lengths at 2-ft. intervals, from 48 to 192 in., while the roll grinder is built in the same lengths up to 168 in. — *Cincinnati Grinders, Inc., Marburg Ave., Cincinnati 9, Ohio.*

(MORE DATA? CIRCLE FYI 55, p. 157)

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FOR YOUR INFORMATION

FREE details about new machines & tools
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FYI—these initials symbolize information that's important. We use them, too, to head our expanded reader service. Here are two postcards which will bring you new literature, bulletins on new equipment, materials or parts, further information from any advertiser, or advice from editors—for a 3-cent stamp.

ALL YOU DO is circle on the lower card the number of any shop equipment item about which you want more data or any piece of manufacturer's literature of which you want a copy.

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NEW BULLETINS

MACHINES AND ATTACHMENTS

1 PLAIN GRINDING MACHINES—*Landis Tool Co., Waynesboro, Pa.* 22-page catalog on the latest design 10- and 14-in. hydraulic cylindrical grinders. Semi-automatic operation and angular wheelhead grinding are described. Specifications are included.

2 AUTOMATIC LATHES—*Sundstrand Machine Tool Co., Rockford, Ill.* 8-page circular on the Model 12A, showing features and describing the cycles obtainable. Includes specifications.

3 PLAIN AND ROLL GRINDERS—*Cincinnati Grinders Inc., Cincinnati 9, Ohio.* 12-page bulletin G-600 covers lines of plain and roll grinders in 16-, 20-, and 24-in. sizes. Includes specifications and standard equipment for each type.

4 MACHINE TOOLS—*Delta Power Tool Div., Rockwell Mfg. Co., Milwaukee 1, Wis.* 60-page catalog illustrates and describes metalworking and woodworking machines. Gives such information as specifications, prices, and motor recommendations.

5 ABRASIVE-BELT MACHINE—*Abrasive Machines Mfg. Div., H. L. Ramsay Co., LaGrange, Ill.* 8-page bulletin describes a portable grinder that may be set at any angle and is adaptable to a large variety of work.

TOOLS AND ACCESSORIES

6 PORTABLE TOOLS—*Skilsaw Inc., Chicago 30, Ill.* 72-page catalog covers over 135 electric and pneumatic tools. Includes specifications and features, applications and uses.

7 COLLETS—*Hardinge Brothers Inc., Elmira, N. Y.* 4-page catalog on draw-in collets for lathes and millers shows major dimensions; max. capacity for round, square, and hexagon; and ordering information.

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66 67 68 69 70 71 72 73 74 75 76 77 78
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FREE details about new machines & tools
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8 ABRASIVE WHEELS — *Simonds Abrasive Co., Philadelphia 37, Pa.* 4-page bulletin describing wheels for tool and cutter grinding, horizontal surface, and carbide-tool grinding. Lists popular sizes and shapes available.

9 POWER CHUCKS — *The S-P Mfg. Corp., Cleveland, Ohio.* 44-page catalog on power chucks, air cylinders, and other equipment. Includes engineering drawings and reference tables. Also included are blank jaws, collet chucks, air valves.

HEAT-TREATING AND WELDING

10 FLAME HARDENING—*The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.* 20-page catalog on the No. 2 Flamatic surface-hardening machine. Features 12 case histories on important applications. Illustrations include operation photographs and photo-micrographs.

11 STUD WELDING — *Graham Mfg. Corp., Ferndale, Mich.* 4-page bulletin describes the company's process and machines for stud welding in a new way. Shows how hopper feeds and index tables speed production.

12 THERMOCOUPLES — *Wheelco Instruments Co., Chicago 7, Ill.* 42-page catalog dealing with instrument sensing units and associated accessories. Includes prices and application recommendations.

PLANT SERVICE EQUIPMENT

13 DUST COLLECTORS — *Torit Mfg. Co., St. Paul 2, Minn.* 28-page catalog illustrates and describes a complete line of collectors and their application to dust problems. Covers both cabinet and separator types from ½ to 5 hp.

14 HOISTS — *Northern Engineering Works, Detroit, Mich.* 8-page booklet describes and illustrates Hi-Lift hoists and hoist cranes. Dimension data for different capacities are tabulated. Closeup and assembly views show details of construction.

15 MATERIALS HANDLING — *The Rapids-Standard Co., Grand Rapids 2, Mich.* 24-page catalog describes Materials Flow equipment; and contains construction features, specification charts, and application tips.

16 CENTRIFUGAL PUMP — *De Laval Steam Turbine Co., Trenton 2, N. J.* 8-page bulletin contains a complete description, cross-section drawing, rating tables, and dimension print on the Type GS pump. Illustrations show other company products.

17 FORK TRUCKS — *Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.* 18-page bulletin shows applications of fork-lift trucks and their attachments. Includes a map showing location of dealers.

18 CONVEYORS — *Industrial Engineering & Manufacturing Co., Inc., Brimfield, Ind.* 2-page catalog sheet illustrates and describes industrial conveyors and gives specifications.

19 HYDRAULIC OILS — *Sun Oil Co., Philadelphia 3, Pa.* 44-page bulletin covers information on hydraulic systems, maintenance, trouble-shooting, and selection of proper fluids.

PARTS AND MATERIALS

20 STARTERS — *The Arrow-Hart & Hegeman Electric Co., Hartford 6, Conn.* 8-page folder gives ratings, dimensions, catalog numbers, and other design data on a line of magnetic starters and contactors.

21 MATERIALS-SELECTION CHART —*The Cooper Alloy Foundry Co., Hillside 5, N. J.* 4-page folder is designed to help in the selection of the most economical material for resistance to corrosive media.

22 VIBRATORS — *Spo Inc., Cleveland 5, Ohio.* 8-page catalog describes a line of pneumatic vibrators and accessory items. Includes specifications.

23 CORROSION-RESISTANT MATERIALS—*Mumaw Products Inc., Div. Poly-cyclo Products Co., Cleveland 10, Ohio.* 8-page folder covers a line of industrial coatings, adhesives, linings, etc., for the processing industries.

24 CYLINDERS — *Logansport Machine Co., Inc., Logansport, Ind.* 14-page catalog gives specifications and describes Air-Draulic cylinders.

25 TITANIUM ALLOY — *Kennametal Inc., Latrobe, Pa.,* 4-page bulletin describes Kentanium, a new high-temperature metal carbide that withstands oxidation and retains great strength at high temperatures.

26 MACHINE PARTS — *The Wel-Met Co., Kent, Ohio.* 4-page booklet 103 describes 25 powdered-metal machine parts. The process used is also described.

MISCELLANEOUS

27 LABORATORY APPARATUS— *Burrell Corp., Pittsburgh 19, Pa.* 906-page catalog, available to laboratories, lists over 25,000 items with a complete description of each.

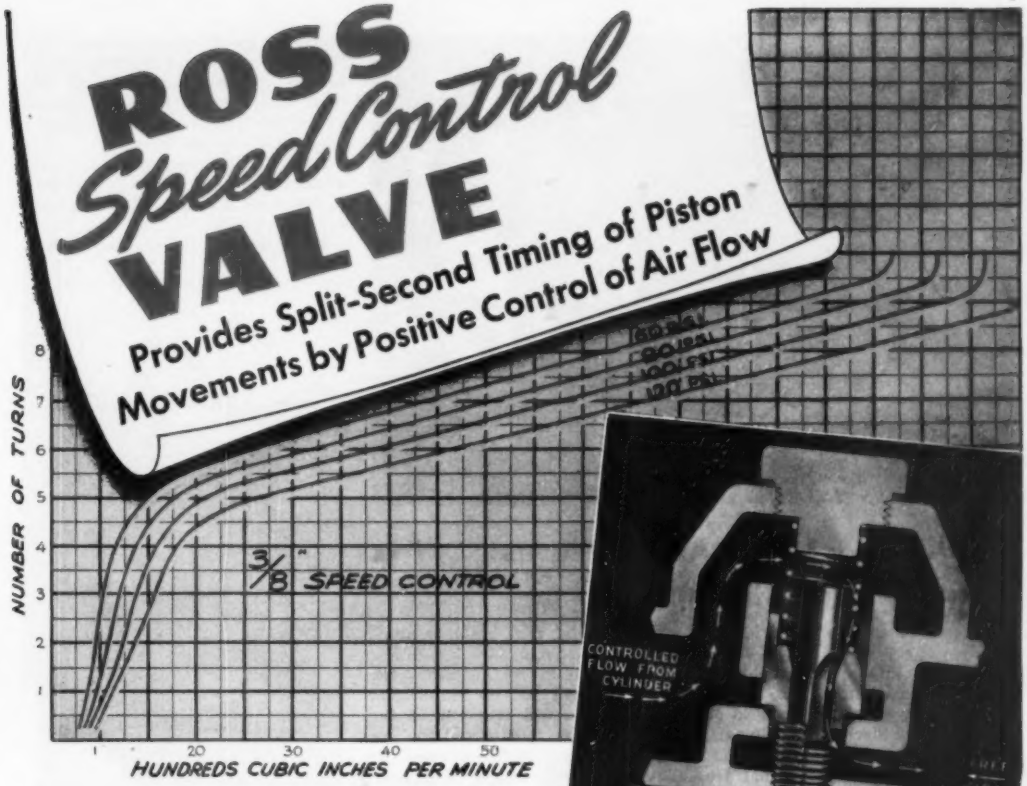
28 TUNGSTEN-CARBIDE ROLLS — *Metal Carbides Corp., Youngstown, Ohio.* 16-page manual covers physical and mechanical properties, design, operating procedure, etc., for rolls used in the cold rolling of metals.

29 MOTOR SERVICE SHOPS — *Reliance Electric & Engineering Co., Cleveland 10, Ohio.* 4-page folder contains information on the service shops of the company in the U. S. A.

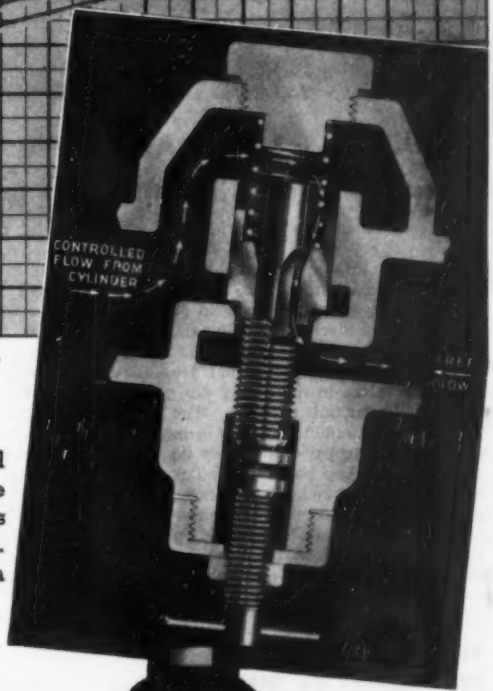
30 PLUMBING LEAD—*Lead Industries Assoc., New York 17, N. Y.* 4-page booklet tells the uses of lead, and how lead pipe and fittings are manufactured.

ROSS *Speed Control* VALVE

Provides Split-Second Timing of Piston Movements by Positive Control of Air Flow



Available in sizes ¼" through 1¼"



With air flow regulated by screw action, changes in volume take place with constant progression—not a series of "steps"—but with micrometer accuracy. Control of the air flow is absolute—from zero to maximum.

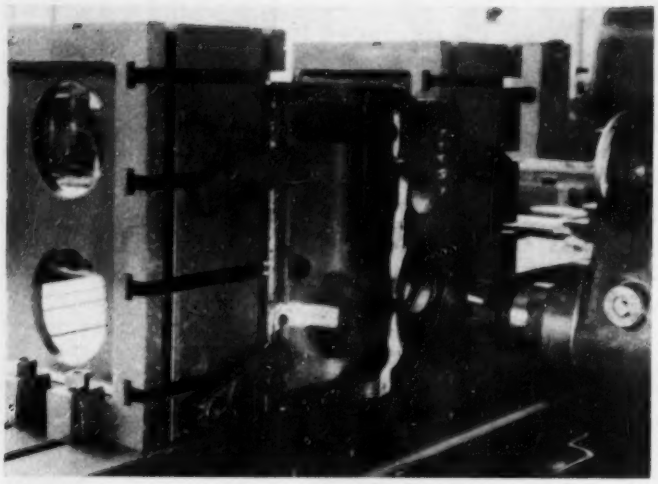
Simple—dependable—rugged. Only two moving parts—stem and poppet.

Ask Ross for Any Air Control Information

ROSS Air Control VALVES

ROSS *Operating* VALVE CO.

120 E. Golden Gate Ave.
DETROIT 3, MICHIGAN



Giddings & Lewis Angle Plates Simplify Work Setups

Designed to insure maximum rigidity and ease of setup, G&L angle plates provide a solid support to hold the work during machining. They permit positioning work at right angles or parallel to the machine-spindle axis. They make it possible to handle odd-shaped or awkward pieces that are difficult to place in machining position on horizontal surfaces. The plates may be used individually or in pairs. If used in pairs, they may be spaced with a gap between, similar to the spacing shown in the photograph to permit through drilling or boring. Or, they may be mounted on top of each other. In this case, locating keyways are provided on the top surface of each plate to allow accurate positioning.

The cored-out ribs decrease the overall weight but do not detract from the general strength of the plates. The face, base and top are machined to accurate squareness. T-slots in the face are spaced both horizontally and vertically and are convenient for placing T-bolts, T-nuts, studs, and clamps when mounting work. Four sizes are available, varying from 15 to 45 in. in length, 12 to 72 in. in height and 12 to 36 in. in width.

Giddings and Lewis Machine Tool Co., Fond du Lac, Wis.

(MORE DATA? CIRCLE FYI 60, p. 157)

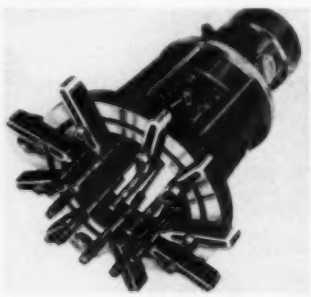
Vi-Speed Air Vises Have Interchangeable Jaw Faces

Vi-speed air-operated vises are available with interchangeable jaw faces. The faces are hardened tool steel with either serrated or smooth surfaces. They are attached to the jaw castings by spring-tempered pins driven into holes. They are easily removed by driving out the pins with a punch.

The vises are said to be especially valuable where heat is applied to the work near the vise. Continual exposure of vise jaws to high temperatures will gradually remove their hardness necessitating replacement.

Van Products Co., Erie, Pa.

(MORE DATA? CIRCLE FYI 59, p. 157)



Adjustable Universal Reduces Work Angle on Drillhead

In this head, the upper or driving end of the spindle universal is adjustable around a circular T-slot. Since the spindle arm is adjusted in the same manner, the working angle can be reduced—cutting down on wear and damage to joints. Also, separated group setups not otherwise obtainable can be made.

Extra spindle units, up to 8 or 10 in number, can be quickly inserted in the same housing as is furnished for two spindles.

Sellew Machine Tool Co., Pawtucket, R. I.

(MORE DATA? CIRCLE FYI 61, p. 157)

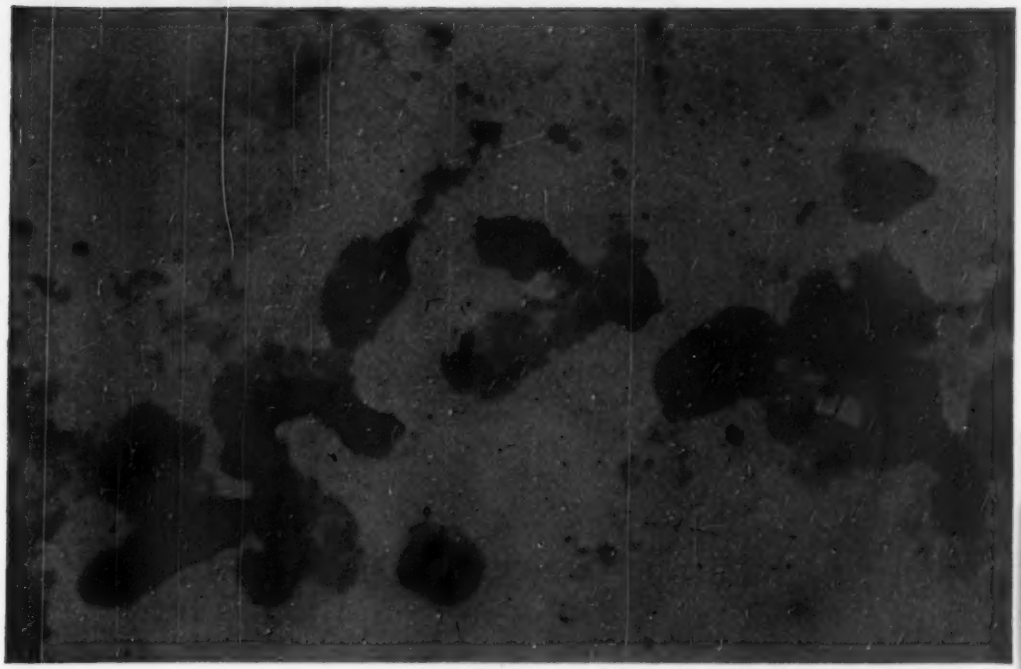
P&W Cutter and Radius Grinder Sharpens Wide Variety of Tools

Simplicity of design makes this Pratt & Whitney machine quick to set up and easy to use. Longitudinal slides and cross slides on both the work-holding unit and the main-spindle assembly, plus a vertical slide on the latter, are said to make for exceptional maneuverability. All movements are governed by positive stops and locks.

The work-holding unit is mounted on a graduated swivel base which enables the operator to blend ball-nose and radius-nose grinds into tangency with the side teeth of an end mill, and to produce draft angles on straight or spiral flutes. The machine is available in two models, the R-6, having a flute-length capacity of 4½ in., and the R-8, which will accept flutes up to 10-in. long. The R-8 will accommodate B&S taper shanks up to No. 12. The R-6 will take up to No. 9 B&S as regularly equipped, and with additional equipment will also accept up to No. 12.

Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford 1, Conn.

(MORE DATA? CIRCLE FYI 62, p. 157)



Bacteria Extracted from Soluble Oils Magnified 29,200X by Electron Microscope.

Deal a Blow to Bacteria!

Deal a blow to bacteria that attack lubricants and coolants causing them to go sour. The measures you take today to forestall the growth of these microorganisms may prevent the occurrence of machine down-time and wasted materials.

Dowicides, Dow's industrial germicides and fungicides, incorporated in cutting, grinding, rolling and hydraulic soluble oil emulsions will provide protection against the growth of bacteria. Thus the service life of the oil will be increased. Dowicides come in both oil and water-soluble types.

Investigate Dowicides today and do away with expensive production delays and costly material wastes caused by bacteria. Complete laboratory facilities are maintained by Dow to help you solve your problems. Contact your nearest sales office or write direct.

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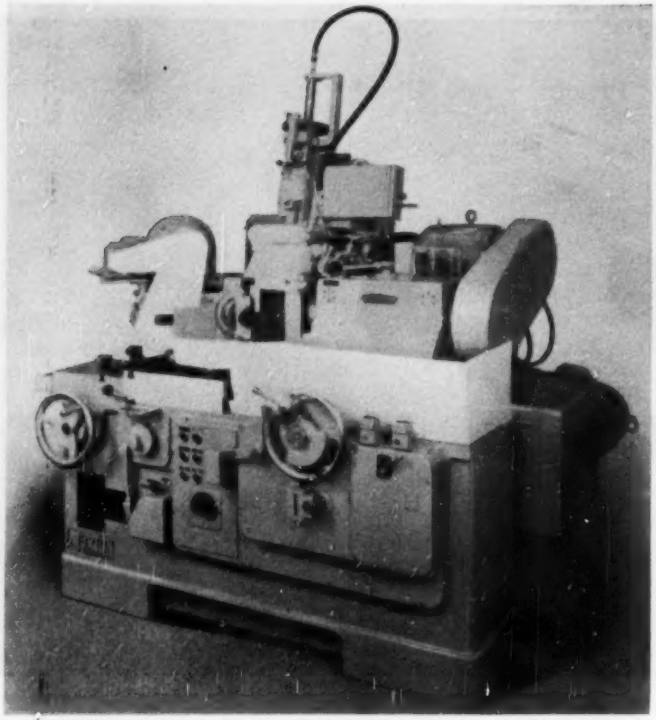
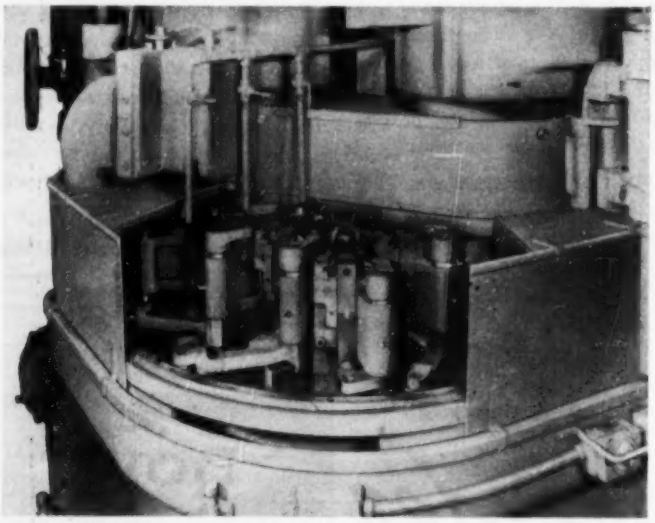
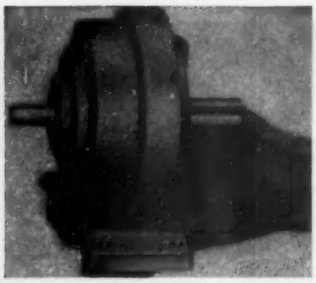


VALVE GRINDER functions under semi-automatic control. Operating effort is confined to loading the machine and to movement of a single control lever. Movement of the lever clamps the workpiece in the workhead collet, starts the grinding cycle, rotation of the workpiece, and coolant flow. All operations stop at cycle completion—*Norton Co., Worcester, Mass.* (MORE DATA? CIRCLE FYI 63, p. 157)



SURFACE GRINDER with special fixture for grinding sides of connecting rods. Pieces are first rough-ground by a coarse-grained wheel mounted on first spindle, after which they are checked by an automatic sizer. Pieces then pass under a fine-grained wheel mounted on the second spindle and are checked again—*Mattison Machine Works, Rockford, Ill.* (MORE DATA? CIRCLE FYI 64, p. 157)



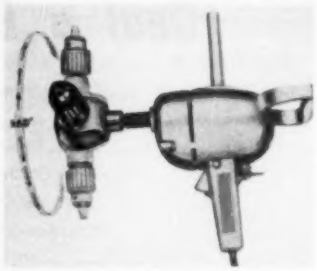
Ball Bearings Used in Compact Speed Reducer

Heliocentric speed reducer, designed to save cost and conserve space in all in-line reducer applications in the ¼- to 1-hp range.

Designated as the Model 5-E, the unit is suitable for any application in which the input rpm does not exceed 1800. Maximum torque capacity is 1000 inch-pounds. Features include the use of anti-friction ball bearings throughout; quiet operation and lower cost due to a reduction in the number of working parts; and high efficiency.

Universal Gear Corp., 19th and Martindale, Indianapolis 7, Ind.

(MORE DATA? CIRCLE FYI 65, p. 157)



Two-Speed Anglehead Drill For Getting Into Tight Spots

This drill has an anglehead which is valuable for getting into tight spots often inaccessible with an ordinary drill. The head rotates through 360° and when it is set at a right angle, the tool measures only 7½-in. over-all width.

Capacities range from ½-in. in steel to 4 in. in soft wood. It has a low speed of 275 rpm for deep bores, and a speed of 1110 rpm for small holes and drilling lumber. A Jacobs chuck makes the anglehead easily removable from the spindle.

Cummins Portable Tools, Div. Cummins Business Machine Corp., 4740 Ravenswood Ave., Chicago 40, Ill.

(MORE DATA? CIRCLE FYI 66, p. 157)

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

Get the profit-protection of easy-handling, straight-driving, non-skid Phillips Screws . . . the modern fastenings that cut assembly time as much as 50%.

And get, *too,* the uniform quality, top "know-how" and unmatched research facilities that are the *special* advantages of AMERICAN Phillips Screws.

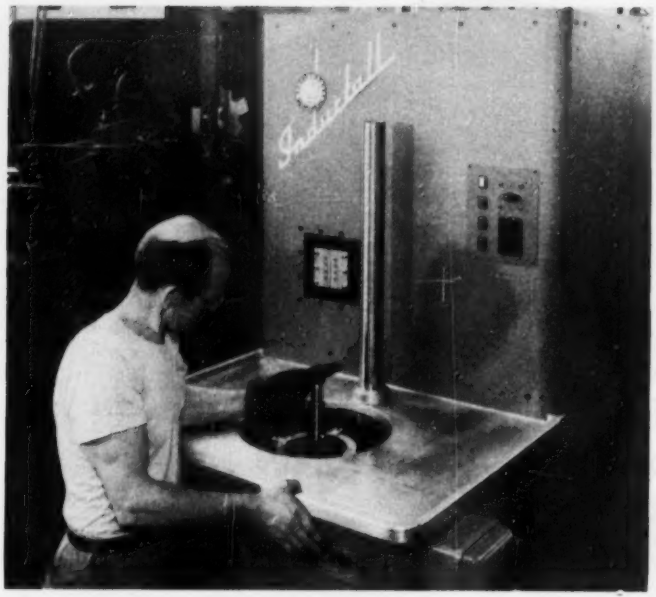
What's more, it's now better business than ever to "fasten with Phillips"... because the Phillips recess is being sold (every month, through the Saturday Post) as a buyer's guide to quality in all types of Phillips-fastened products.

And whenever you *think* of Phillips Screws, remember that it pays to *say:* "AMERICAN Phillips Screws!"

American Screw Co., Willimantic, Conn.

AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)



Induction Heater Puts Gears Through Automatic Cycle

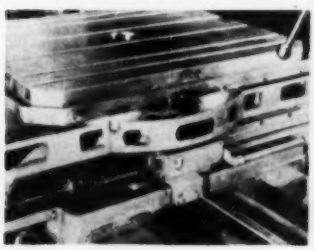
This machine, called the Inductall, is used with a vacuum-tube radio-frequency generator, a 10,000-cycle motor-generator set, and other associated equipment. It hardens spur gears, cluster gears, integral spindle gears, and shafts; carrying each gear through an automatic cycle for either through or contour hardening of each part.

Uniformity is said to result from the mechanical handling system and precise electrical timing of the preheat, heat-treat, and quench operations. Automatic loading and unloading magazines are available as optional accessories.

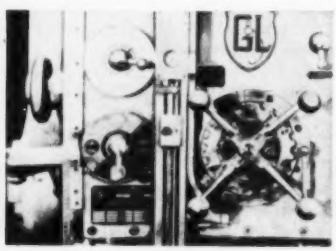
Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

(MORE DATA? CIRCLE FYI 67, p. 157)

Electric Positioning Device Ends Manual Machine Settings



This device reduces the time taken to locate work for precision machining operations. In addition to time saved in work setting, it is said to reduce or eliminate special jigs and fixtures.



It consists of two complete control units, one for lateral setting of table on the saddle, and the other for vertical setting of the headstock on the machine column. These units may be operated individually or simultaneously, depending upon the requirements of the job. When components of the positioning device are activated, they disengage the table and headstock rapid-traverse directional controls and then automatically position the table or headstock in its final setting.

A starting point is first determined —which can be anywhere on the face of the workpiece being machined. Measurements are then made from this point with conventional end-measuring rods if a single part is being bored. Or for production work, a job rod, bored with various hole spacings on each of its four sides to receive a stop pin, is used to simplify repetitive settings. To set the machine table, rods are placed in a U-trough located on the front side of the table. To control headstock settings the rods are clamped to a vertical shaft attached to the machine column. The rods rest between an adjustable stop and a permanently mounted dial indicator.

After the desired travel has been determined and the rods are in place, directional controls are manually engaged. The table and headstock move in rapid traverse until the directional clutches are automatically disengaged by a selector switch. There is a slight over-travel of approximately 0.005 to 0.010 in. at this point in the cycle.

During this interval of travel, a master electrical switch is energized to start a constant-speed motor connected to a reduction-gear unit. Through a magnetic clutch attached to the reduction unit and the machine feedscrew, the table and headstock are automatically fine fed in a return stroke within 0.0002 in. to 0.0005 in. of the desired machine setting. When this point is reached and shown on the dial indicator, the magnetic clutch disengages.

Giddings and Lewis Machine Tool Co., Fond du Lac, Wis.

(MORE DATA? CIRCLE FYI 68, p. 157)

Electronic tachometer for high-accuracy revolution and frequency measurements. The instrument totalizes the number of counts derived from the source being measured during a precisely established time interval of 0.6 sec. This reading is displayed on a four-digit electronic counter using 10 neon lamps for each digit. After each measurement period, the instrument automatically resets and recycles.

Potter Instrument Co. Inc., 115 Cutter Mill Road, Great Neck, N. Y.

(MORE DATA? CIRCLE FYI 69, p. 157)

Hjalmar Ellstrom

INVENTOR OF THE GAGE BLOCK

The achievement of perfection . . . the complete mastery of any art or craft or science . . . is a rare human accomplishment. A discovery or an invention that contributes to the progress and total welfare of all mankind is rarely the heritage left by a single man. So rare is it, indeed, that in such infrequent instances, the true facts surrounding its origin are often distorted, obscured, or even lost in the conflicting claims of others who would seek the personal worldly gains to be derived from undeserved fame.

So it was with the Gage Block. For, actually, this basic standard of measurement now used the world around was originally conceived, developed, and invented solely and entirely by . . . Hjalmar Ellstrom.

Here, briefly, is the story of his accomplishment: During the early 1890's, Hjalmar Ellstrom was employed by the government rifle factory at Eskilstuna, Sweden. He was a master craftsman . . . a man of infinite patience who took great pride in his work. He was a man of vision, too, who recognized the limitations imposed upon industry by the lack of sufficiently accurate measuring devices. So, with a then unheard of standard of precision as his ultimate goal, he alone developed and perfected his checking instruments and techniques . . . then alone he created the world's first gage block accurate to the infinitesimal millionth part of an inch.

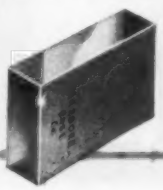
Today, though his achievement has been copied and imitated by others, his personal unqualified devotion to accuracy is the exclusive heritage of Ellstrom.

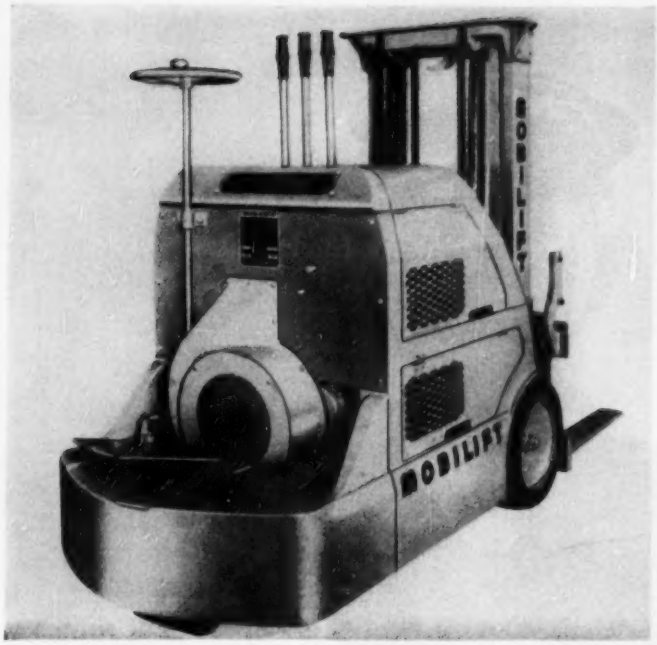
ELLSTROM . . . *measuring in millionths for three generations*

DEARBORN GAGE COMPANY

22033 BEECH STREET • DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks





Accessibility of Parts in Fork Trucks Reduces Downtime

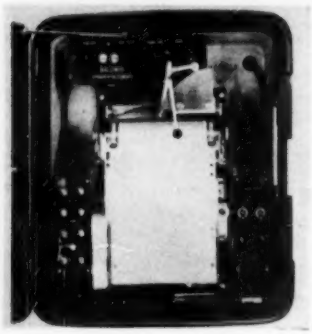
Two models of fork-lift trucks, both of 2000-lb. capacity, have features designed to increase the accessibility of parts requiring regular servicing and maintenance.

A stand-up Model E features a 1-piece hood that may be completely removed by taking out six bolts. The battery, oil-bath air cleaner, oil filter, and other parts have been placed for easy accessibility through large double-hinged side panels.

Another model, the ER, a sit-down type, has knee-action rear wheels. Each wheel is independently sprung, using a heavy-duty spring and an airplane-type shock absorber. A large flywheel fan draws fresh air under the operator's seat, and over and around the cylinders. The hot air is then forced through the side panels away from the driver, making the ER cooler and more comfortable for the driver. Four eyes make it easy to lift. Both models have a 3-cylinder heavy-duty engine, designed specifically for fork-lift trucks.

Mobilift Corp., Portland, Oregon

(MORE DATA? CIRCLE FYI 70, p. 157)



Strain Recorder for Continuous Measurement of Surface Strain

A strip-chart recorder for surface strain measured by SR-4 resistance-wire gages. It is an electronic instrument designed and calibrated for use with two SR-4 gages having a resistance of 120 ohms and a sensitivity factor between 1.9 and 2.2

Available ranges in the instrument are 0 to 2000, 0 to 5000, and 0 to 10,000 microinches per inch. It provides ten chart speeds within a range of ¾ in. to 720 in. per hr., or 12 ipm. The pen moves across a 4½-in. wide chart in a straight line, thus making coordinated readings of time versus strain simple.

The Baldwin Locomotive Works, Philadelphia 42, Pa.

(MORE DATA? CIRCLE FYI 71, p. 157)

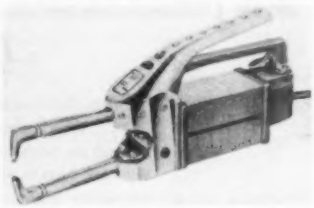
Dual-Spotlight Soldering Gun Eliminates Shadows

Dual spotlights to eliminate shadows, and over/under terminals to brace tip and improve visibility, are features of this light-duty soldering gun.

Among other features are dual heat (100/135 watts) for all light and delicate soldering; 5-sec heating to save time and current; and a trigger-switch control which adjusts heat to the work and eliminates need of unplugging the gun between jobs.

Weller Electric Corp., Easton, Pa.

(MORE DATA? CIRCLE FYI 72, p. 157)



Portable Spotwelder Requires One Hand to Operate

The fixed top tong of Zip spotwelders permits resting the weight of the welder on the exact welding spot. This gives added contact pressure for a sound weld, and reduces operator fatigue. The center of gravity is at the carrying point and, therefore, requires but one hand to operate.

Assorted tong lengths and shapes are available for specific operation. The unit will weld mild steel, stainless, galvanized iron, terneplate, and magnesium up to ⅛-in. combined thickness of metal. Models are available for either 110-volt or 220-volt.

Mid-States Welder Mfg. Co., 6025 S. Ashland Ave., Chicago 36, Ill.

(MORE DATA? CIRCLE FYI 73, p. 157)

Which way do you DRILL DEEP HOLES ?

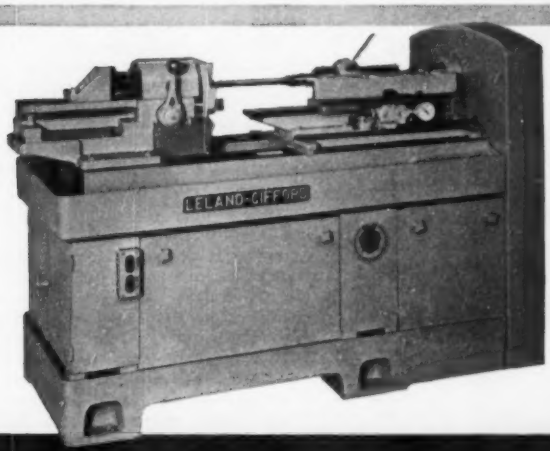
The "DRILL-KILLER" way

Keeps the drill cutting until it cries "uncle". RESULT: flutes and holes clogged with chips, coolant crowded out or burned away, drills run off, cut slowly, dull quickly, break frequently. Production down, costs up.

The Safe, Accurate LELAND-GIFFORD WAY

Patented *Step by Step* Hydraulic Feed automatically retracts the drill at frequent, predetermined, *safe* intervals to clear the chips and replenish coolant. RESULT: straight holes, drills stay cool and sharp, more holes drilled between grinds, less drill breakage. Production up, costs down.

If you drill holes from 4 to 60 or more diameters in depth, it will pay you to look into the LELAND-GIFFORD METHOD. Write for complete information.



A Leland-Gifford Single Spindle, Self-Contained, Horizontal Deep Hole Drilling Machine. The patented Leland-Gifford *Step by Step* Hydraulic Feed can be furnished for angular or vertical as well as horizontal deep hole drilling—with infinitely adjustable feed rate and overload protection plus automatic stop and reset — in steps and total traverses to meet your requirements.

PRODUCTION MEN

Get This Handy Slide Rule

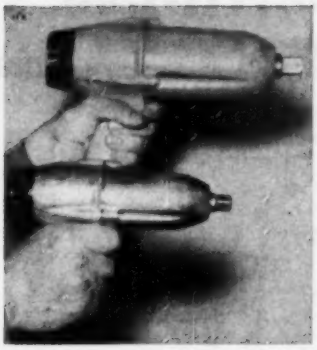
A valuable aid in figuring costs and setting production schedules. Quickly gives time required to drill holes of any size and depth in any material. It's free. Write the nearest office.

LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 6, 565 W. Washington Blvd.; DETROIT 26, 1533 Dime Bank Bldg.; CLEVELAND 1, P. O. Box 5547; NEWARK 2, Industrial Office Bldg.; ROCHESTER 4, Commerce Bldg.; LOS ANGELES 14, 724 So. Spring St.



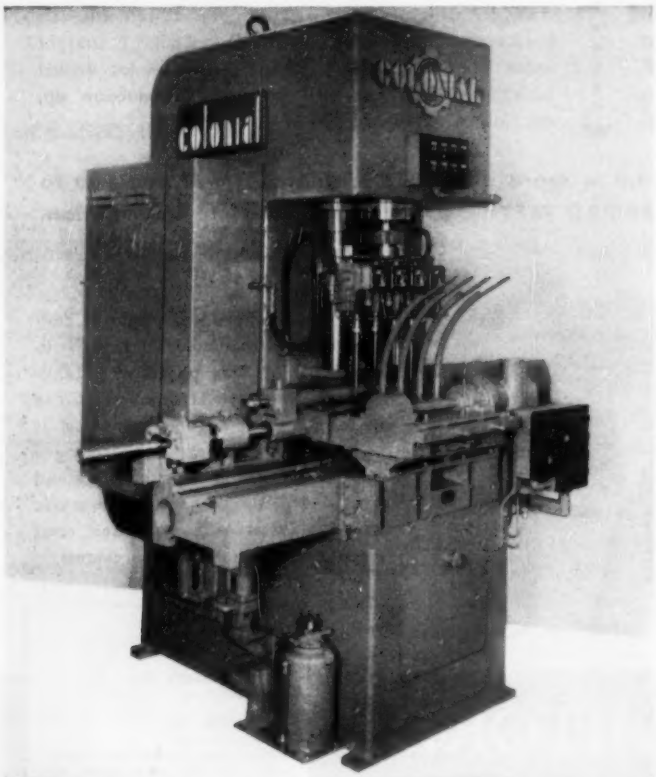
Noise from Nut-Running Tools Cut to Minimum

Two air-operated impact tools, the size 504 for nut-running up to ⅜-in. bolt size and the size 510 for nut running up to ¾-in. bolt size are available. The 504 is a completely redesigned tool, 20% more powerful and 65% faster than the old model. Due to effective muffling, it takes 100 new 504's to equal the noise of one of the old. The 504 may also be used for multi-purpose operation in drilling up to ⅜-in. diameter, or step drilling to ¾ in., reaming up to 9/16-in. diameter, tapping up to ⅝-in. diameter, driving screws up to ⅜-in. machine, and for many other uses.

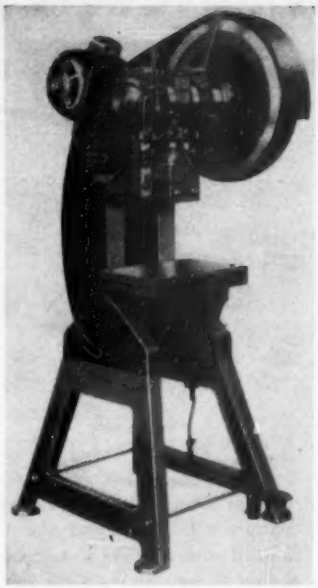
Both tools have a pistol grip, and are well balanced for ease of operation. The reverse caps are deeply grooved so the tools may be quickly reversed even with greasy hands. Both tools have a high run-down speed before impacting starts. Service life has been increased by built-in air strainers.

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

(MORE DATA? CIRCLE FYI 74, p. 157)



ASSEMBLY PRESS for a cylinder-head production line has a 15-ton capacity. A 3-station machine, it presses valve guides into place, four at a time. The six-step cycle includes automatic location of the cylinder head. Inspection is provided by switches which interrupt the cycle if any one of the fits is too tight or too loose.—*Colonial Broach Co., Detroit, Mich.* (MORE DATA? CIRCLE FYI 75, p. 157)



Single-Stroke Inclinable Press Has Sliding-Key Clutch

This positive, single-stroke press has a sliding-key clutch with a four-point engagement ring, and a roller-bearing-mounted flywheel. The diameter of the crankshaft at the bearing is 2⅛ in. and at the pin 2⅜ in.

Standard stroke for this 15-ton press is 2 in.—longer strokes up to 3 in. available if required. The bolster area is 10x14⅜ in. The distance from bolster to slide is 6¾ in. It has a 5½-in. throat depth.

Sales Service Machine Tool Co., 2363 University Ave., St. Paul 4, Minn.

(MORE DATA? CIRCLE FYI 76, p. 157)

Slewing crane arm attached to fork trucks permits rapid, easy positioning in freight cars of loads up to 800 lb at an 80-in. load center. The arm is pivoted so that a two-way hydraulic cylinder can swing it laterally 20° to either side of center.

Towmotor Corp., Cleveland, Ohio

(MORE DATA? CIRCLE FYI 77, p. 157)

Cabinet bench has steel construction, ample storage space, standardized units, and interchangeable accessories. A back board prevents tools and work from sliding off. The bench top can be made of steel or hard wood of 1¾ or 2⅝ in. thickness.

Standard Pressed Steel Co., Jenkintown, Pa.

(MORE DATA? CIRCLE FYI 78, p. 157)

YOU CAN RELY

ON THE TOOTH-TO-TOOTH ACCURACY OF A FARREL® GEAR

The quiet, vibration-free performance and long gear life you can expect from a Farrel herringbone gear result from extreme accuracy of tooth spacing, contour and helix angle — qualities inherent in the Farrel-Sykes method of gear generation.

The herringbone design offers the advantage of a maximum number of gear teeth always in mesh. Overlap or interlacing of the teeth, together with gradual engagement, contribute to smooth operation. Opposed helices balance and absorb axial thrust within the gear member, eliminating harmful thrust loads and resultant stresses on other parts of the machine.

Farrel-Sykes herringbone gears are made of the finest grade materials, in a complete range of sizes, from ¼ inch to 20 feet diameter, ¼ to 60 inch face, 24 DP to 0.75 DP, for any power capacity and any application.

Farrel engineers are available to assist in working out unusual gear problems. Information will be sent on request.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.
Plants: Ansonia and Derby, Conn., Buffalo, N. Y. *Sales Offices:* Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Cleveland, Cincinnati, Detroit, Chicago, Los Angeles, Tulsa, Houston, New Orleans.

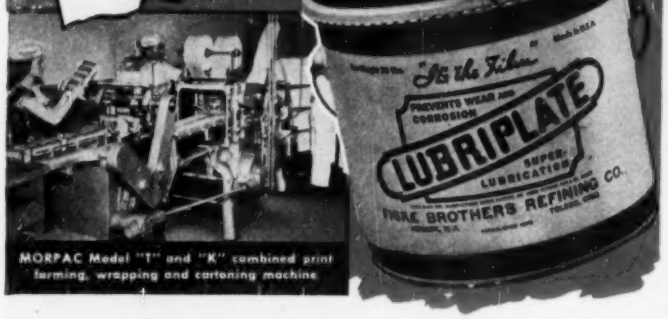
Farrel-Birmingham

FB-622

LYNCH CORPORATION of Toledo, Ohio,
—a leading manufacturer of packaging machinery

—says

"This Lubricant Reduces Service Calls!"



MORPAC Model "T" and "K" combined print forming, wrapping and cartoning machine

The following quotation is taken from a letter we received from their Director of Sales:

"The majority of our machines are used in places where it is necessary to wash them with steam and hot water after each day's use. This naturally would remove any ordinary lubricant and trouble would develop if the machines were not immediately relubricated. With LUBRIPLATE it is different. There is always a film of LUBRIPLATE left on the machine after washing. This gives protection not only to moving parts, but also prevents general corrosion. The presence of salt and lactic acid in packing plants makes oxidation a hazard. LUBRIPLATE prevents this too.

"LUBRIPLATE greatly reduces unnecessary wear and prolongs the life of machines. It has reduced customer calls for service to a minimum. Our Service Engineers can readily spot machines that have had other than LUBRIPLATE Lubrication, as these machines do not give the service they should.

"After using LUBRIPLATE for over ten years, we are very well pleased with it and enthusiastically recommend it."

A LUBRICANT must be more than good to warrant such a recommendation. The Lynch Corporation, as well as hundreds of others who build machines to sell, not only use LUBRIPLATE Lubricants in their own shops, but also advise the buyers of the machines to always use LUBRIPLATE for re-lubrication.

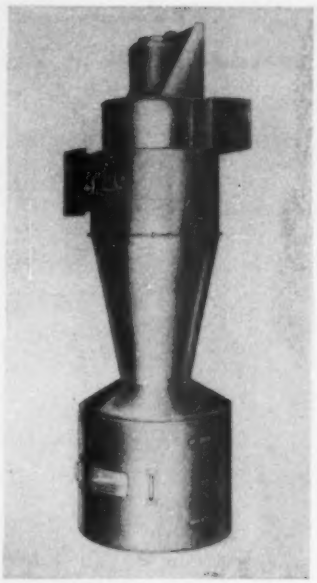
LUBRIPLATE Lubricants are different from all other lubricants. They have properties all their own . . . they reduce friction and wear, prevent rust and corrosion and save power. They stay put under most adverse conditions and do not run out or wash away.

There is a LUBRIPLATE Lubricant that is just the right density for your requirements. Let us tell you about it. *Write today.*

LUBRIPLATE DIVISION
Fiske Brothers Refining Company
Newark 5, N. J. Toledo 5, Ohio

DEALERS EVERYWHERE—CONSULT YOUR CLASSIFIED TELEPHONE BOOK

LUBRIPLATE ***THE MODERN LUBRICANT***

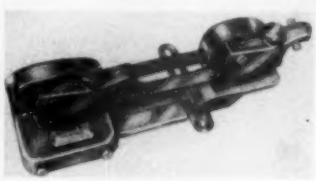


Large Capacity Put in Hammond Dust Collectors

Hammond has added two models to their line of Cyclone dust collectors. Model CYO-6, as shown, is recommended for exhausting air to the outside. Model CYB-6, is of the same construction but is fitted with a dustproof bag, and is adaptable where conditions permit recirculating the air.

Their larger dust capacity, and 2-hp. motor provides a heavy-duty dust-collecting system. Capacity of both models is 1150 cfm.

Hammond Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo, Mich.
(MORE DATA? CIRCLE FYI 79, p. 157)



Dickerman Hitch Feed Handles Light-Gage Stock

This 2½-in. hitch feed is claimed to be the first feed for handling the lighter gages of stock from 0.003 in. to 0.050 in. in thickness, making possible the feeding of these lighter materials without buckling. It is designed for mounting on any press or to the dieset.

No tools of any kind are required

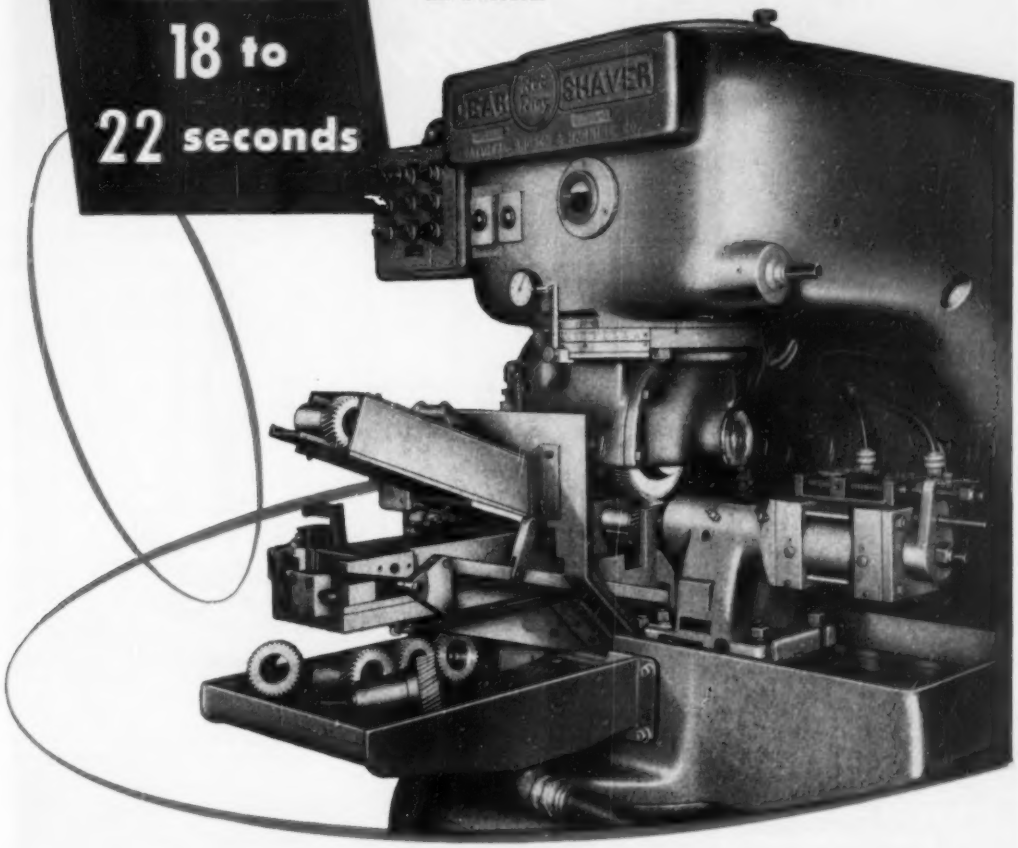
Transmission Gears

shaved in 18 to 22 seconds

The gear on this automatic transmission reverse drive sleeve is 2⅛" in diameter with a ⅞" face, 33 teeth and 14 normal D.P.

It is being shaved on this Red Ring Diagonal Gear Shaving Machine equipped for fully automatic loading at a rate of from 165 to 200 per hour, removing .0025" to .0015" of stock on tooth thickness. Rates up to 300 per hour have been recorded on smaller automotive transmission gears.

Automatic loading gives you not only the highest production rates, but it also minimizes operator fatigue and assures extremely close tolerance gears with ordinary machine operators—no special skill is needed.



WRITE FOR DESCRIPTIVE LITERATURE ON RED RING GEAR SHAVING AND AUTOMATIC LOADING

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

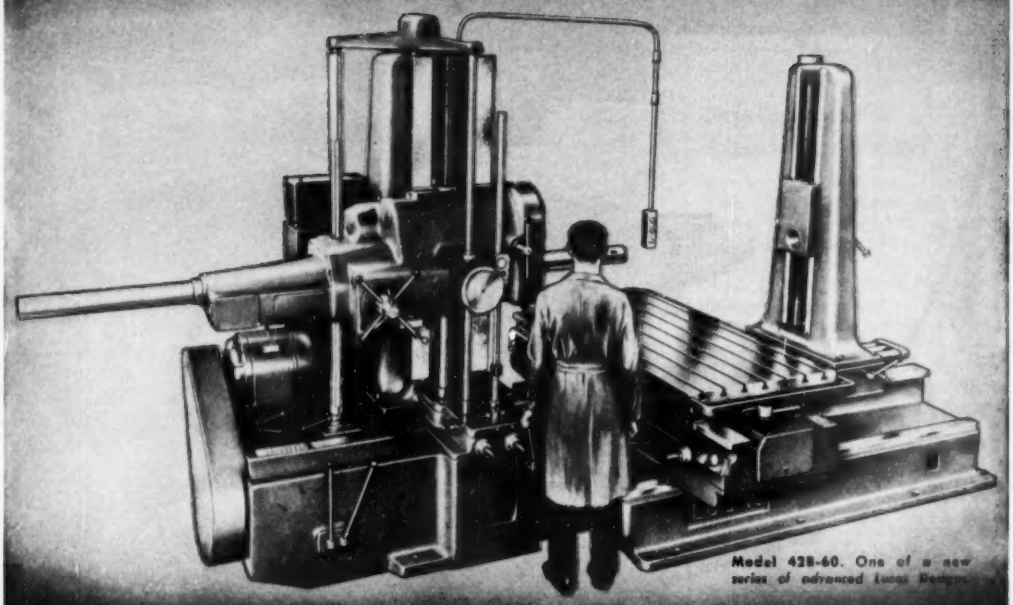
WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

FIFTY YEARS LUCAS OF CLEVELAND ONE PRODUCT

LUCAS

Precision

Horizontal Boring, Drilling and Milling Machine



Model 428-60. One of a new series of advanced Lucas Designs

Both a tool room and a rugged production machine. It can be *automatically power positioned* without the use of jigs and fixtures. Positively repeats a series of operations on any required number of large or small pieces.

Built in 3", 4", 5" and 6" diameter spindle models, all with a choice of two-way or four-way beds. Unit feed selection through manually operated directional control levers or through electrical multi-position pendant is optional on some models. May we send you descriptive literature.

LUCAS *Precision*

HORIZONTAL BORING, DRILLING AND MILLING MACHINES

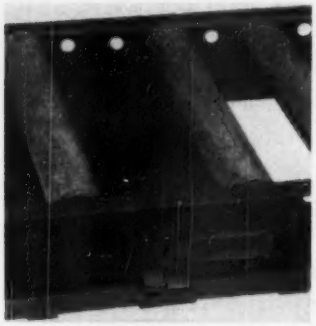
LUCAS MACHINE DIVISION, THE NEW BRITAIN MACHINE CO.

CLEVELAND 8, OHIO

to make adjustments for gripping pressure or feed length, and the design automatically maintains the proper gripper-plate angle. The wear and gripping plates are of Carboloy.

H. E. Dickerman Mfg. Co., Springfield, Mass.

(MORE DATA? CIRCLE FYI 80, p. 157)

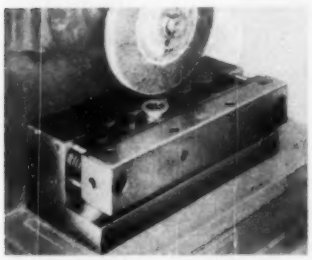


Coupling of Roller Conveyors Made Easy by Lock

Roller conveyor, called Metalok, has a coupling which speeds attaching one length to another and then locking them in place with a positive grip. Another feature makes it necessary to turn only the curve in order to change the directional flow of the conveyed material.

Steel Parts Mfg. Co., Div. Blackstone Mfg. Co. Inc., Chicago, Ill.

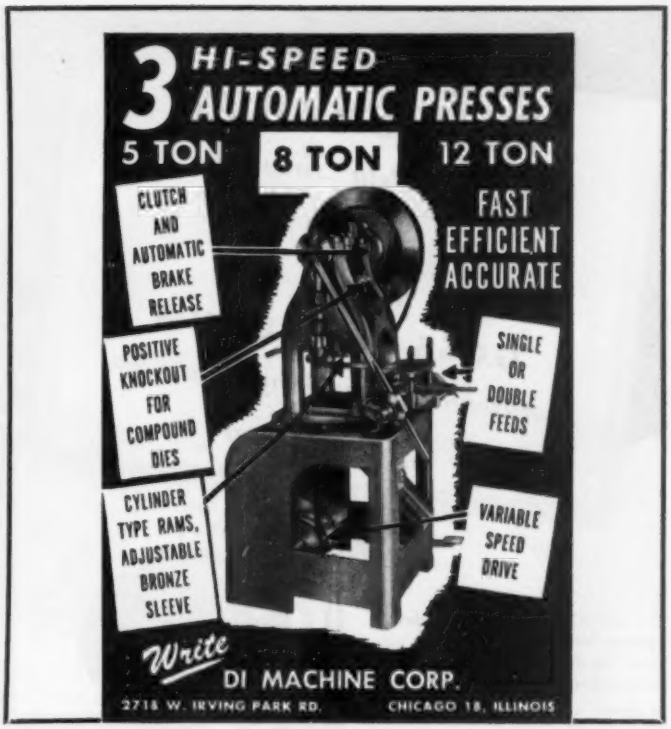
(MORE DATA? CIRCLE FYI 81, p. 157)

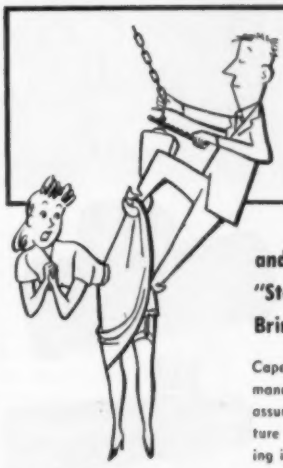


Equalizing Blades in Gang Vises Account for Tolerance Differences

Two gang vises for precision grinding of small parts have equalizing blades which automatically compensate for differences in work tolerances. It is claimed that this eliminates the "toeing in" of undersize parts. The vises hold the work in a central position, making it possible to turn the fixture for grinding opposite sides without adjustments.

The three-position model is de-





It's the CUT that COUNTS

and CAPEWELL'S Exclusive "Statistical Quality Control" Brings You a 10% Sawing Bonus

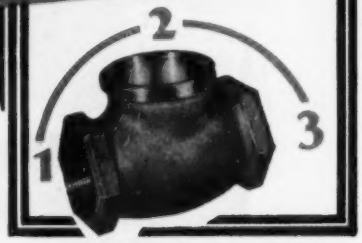
Capewell's exclusive "Statistical Quality Control" during manufacture eliminates sub-standard hack saw blades—assures you a bonus of 10% extra cutting. Another feature exclusive with Capewell is the printed blade, carrying instructions for proper use.

Ask your distributor, too, for these other Capewell Quality tools: hack saw frames, band saws (in coils or welded), Dafiles, ground flat stock, hammers, pipe and bolt threaders, pipe cutters, pipe reamers, pipe vises, tubing cutters, power pipe machinery.

CAPEWELL
THE KEY TO ECONOMY

THE CAPEWELL MFG., CO., DEPT. 311, HARTFORD 2, CONN.

ALL ENDS OF PARTS
Completely Finished
"1·2·3"
ON THE
GOSS *and* DeLEEUW
Automatic Chucking Machine
in 1 SET-UP

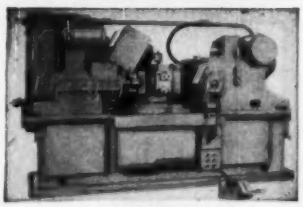


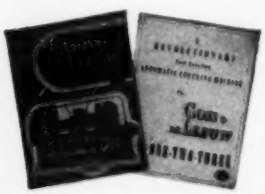
This recent Goss & DeLeeuw development has already received universal acclaim as an outstanding development.

In speed, ease of tooling and precision finishing, the "1-2-3" chucker provides engineering advantages which result in vastly greater production at a fraction of parts' costs by other methods.

Easy, fast change-over from job to job makes this machine ideal for short-run requirements. Sturdy construction, power and speed make its advantages apparent on long runs.

"1-2-3" means ability to handle work requiring machining operations on one, two or three ends simultaneously or in sequence — a method exclusive with Goss & DeLeeuw and offered on this machine.





Illustrated literature available promptly on request. Send samples of your work for time and cost estimates.

GOSS & DeLEEUW

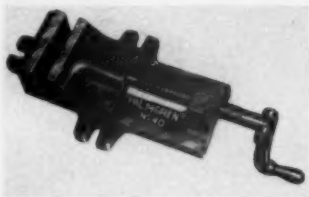
GOSS *and* DeLEEUW
MACHINE COMPANY, *KENSINGTON, CONN., U.S.A.*

signed for use with a magnetic chuck, but may be modified for clamping to conventional chucks. Capacity is ¾x1½ in.

The six-position vise can be used with either magnetic or non-magnetic chucks. Capacity ranges from ⅛ to 1 in.

Dery Tool & Die Co., Pine Meadow, Conn.

(MORE DATA? CIRCLE FYI 82, p. 157)



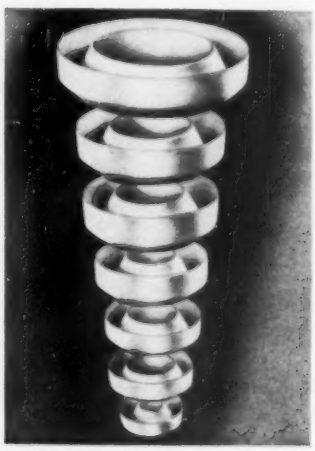
Palmgren Drillpress Vise Avoids Costly Jigs and Fixtures

The movable jaw on this Palmgren No. 40 vise is grooved vertically for holding round work. It has jaws 3½ in. wide, opens 3½ in., and has a jaw depth of 1⅝ in.

The adjusting screw has a coarse-pitch Acme thread for fast action, and a swivel crank handle.

Chicago Tool & Engineering Co., 8383 South Chicago Ave., Chicago 17, Ill.

(MORE DATA? CIRCLE FYI 83, p. 157)



Teflon V-Ring Packings Have Low Friction Characteristics

These V-ring packings are claimed to combine the chemically inert and low-friction properties of Teflon with resilience and toughness needed for proper sealing results. They are said to insure permanent sealing,

Parts for NEW "Caterpillar" Tractors machined by KENT-OWENS

New "Caterpillar" Diesel DW20 Tractor and W20 Wagon hauling heavy clay.

After five years of research, testing and proving—"Caterpillar" has announced two great new Tractors . . . and Kent-Owens Milling Machines help to save production costs.

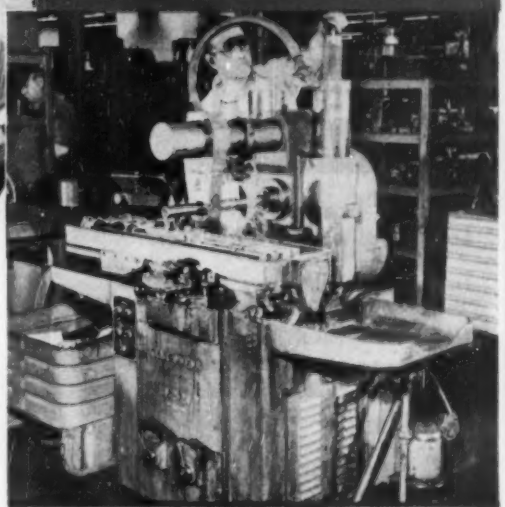
These new "Caterpillar" products are high-speed, long haul and high-capacity earthmoving machines built by Caterpillar Tractor Co., Peoria, Ill. The new units are a four-wheel Diesel tractor-wagon combination, the "Cat" DW20 Tractor with W20 Wagon; and the powerful two-wheel Diesel prime mover, the "Cat" DW21 equipped with the No. 21 Scraper.

The Kent-Owens Machine in the upper photo is milling bearing lock slots in connecting rods and caps. Due to the flexibility and ease in setting up Kent-Owens machines, the Caterpillar Company have found these machines can be easily adapted for a wide variety of operations. The machine in the lower photo is used for milling operation on compression release levers, clutch control levers, governor control levers and bell cranks. Write for Bulletins. Also, let our engineers help you with tooling and special machine requirements. Kent-Owens Machine Co., Toledo, Ohio.

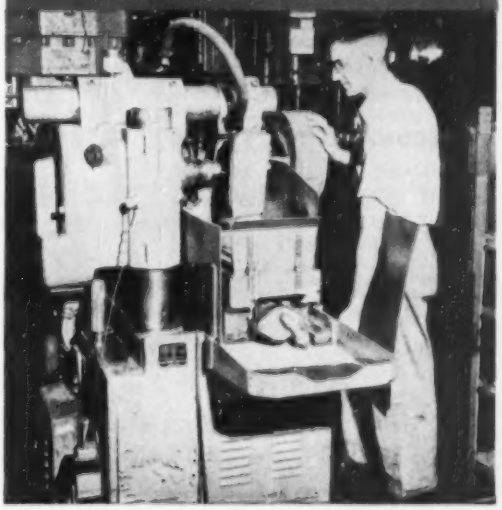
Call on

KENT-OWENS

for Milling Machines



Here are two Kent-Owens No. 2-20 Milling Machines in use at Caterpillar Tractor Co. These milling machines have 42" x 12" table, and 20" table travel.



There's Something NEW in the WENDT-SONIS Tool Crib

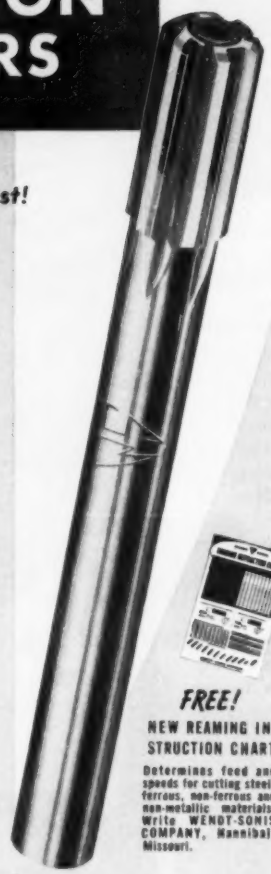
WENDT-SONIS
Carbide Tipped
EXPANSION REAMERS

Greater Accuracy . . .
Long Tool Life at Low Cost!

Here's the latest addition to the big Wendt-Sonis reamer family! W-S Expansion Reamers provide easy and *extremely accurate* expansion wherever a true hole and fine finish are needed. Diamond lapped cutting edges insure free cutting action. Extra bearing surface in the hole obtained with *extra long* carbide tips. Rust-resistant tool shanks made from highest quality heat-treated materials. W-S Expansion Reamers available in a wide variety of sizes to meet all job requirements.

WELCOME TO THE FAMILY!

ADJUSTABLE REAMERS • LEFT AND RIGHT HAND SPIRAL REAMERS • STRAIGHT FLUTE REAMERS • CARBIDE FULL-LENGTH FLUTE REAMERS • STUB SCREW MACHINE REAMERS • SHELL REAMERS • JOBBER REAMERS



FREE!
NEW REAMING INSTRUCTION CHART
Determines feed and speeds for cutting steel, ferrous, non-ferrous and non-metallic materials. Write WENDT-SONIS COMPANY, Hannibal, Missouri.

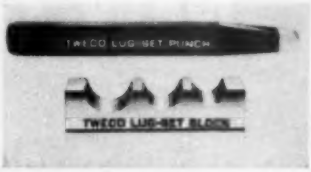
WENDT SONIS
CARBIDE CUTTING TOOLS

Boring Tools • Centers • Counterbores • Spotfacers • Cut-Off Tools • Drills • End Mills • Fly Cutters • Tool Bits • Milling Cutters • Reamers • Roller Turning Tools • Special Bits

even under varying pressures, at temperatures up to 450 F.

Crane Packing Co., Dept. G22, 1800 Cuyler Ave., Chicago 13, Ill.

(MORE DATA? CIRCLE FYI 84, p. 157)



Block and Punch Set for Installing Cable Lugs, Splicers

This block and punch set mechanically installs the company's new line of lugs and splicers—which are designed especially for welding cables. The manganese-bronze block has three half-circle depressions to take three sizes.

To use this tool, the end of the cable is stripped and inserted in the lug or splicer. Using the correct size indentation and the punch, the barrel of the lug is impacted into the cable strands.

Tweco Products Co., Wichita 1, Kansas

(MORE DATA? CIRCLE FYI 85, p. 157)

Welding electrode, designated as Smithway SW 80 for field welding of line pipe. Coating is of the cellulose type, said to produce a deep-penetrating cutting arc. Because of only a slight slag covering, the welder has a clear view of the molten puddle at all times. Available in 5/32- and 3/16-in.-diameter sizes.

Welding Electrode and Equipment Div., A. O. Smith Corp., Milwaukee, Wis.

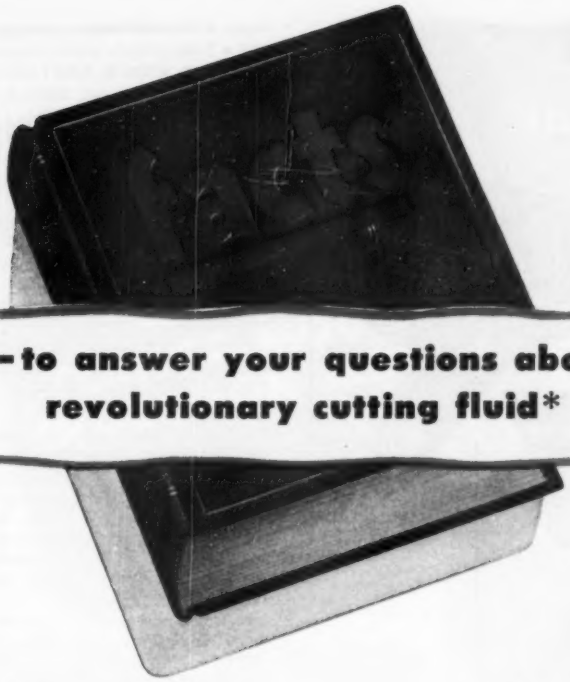
(MORE DATA? CIRCLE FYI 86, p. 157)

Work glove features a continuous seam on the back of the thumb. The elimination of seams on the front is said to assure longer life for the glove. Made of chrome-tanned, side-split, pearlgrey cowhide with a striped herringbone-flannel back, the glove has a water-resistant cuff which may be safely dry cleaned.

Richmond Glove Corp., Richmond, Ind.

(MORE DATA? CIRCLE FYI 87, p. 157)

Dolly racks that can be conveniently pushed by hand in assembling individual orders and then towed in trains to the loading area. Here they can be stacked to conserve floor space until the carrier is ready to receive the shipment. Features in-



—to answer your questions about this revolutionary cutting fluid*

Q. Will ANTISEP All-Purpose Base work safely in automatics?

A. *Yes. It has been and is being used in every type of screw machine. The Houghton Man has data on how to clean up machines before installing and how to handle machine lubricant mixes.*

Q. Will ANTISEP A. P. Base gum up, or cause gumming?

A. *Any gumming which might occur is the result of putting this coolant in dirty machines. The new mix should be run for a day or two and then dumped to get rid of "gunk" loosened by the washing action of A. P. Base. Water softener may be needed in some localities.*

Q. Will Antisep A. P. Base live up to its name as regards antiseptic value?

A. *Yes. No dermatitis complaints have been recorded. A powerful germicidal additive prevents growth of "bugs." Operators like the antiseptic ability of A. P. Base.*

Q. Should Antisep A. P. Base be used for grinding?

A. *Not usually recommended for grinding, as film strength additives tend to load up the wheel. Here we advise ANTISEP SOLUBLE GRINDING OIL.*

Q. Can this Base be used as a drawing lubricant also?

A. *Yes. It may be mixed with equal parts of oil or water and used for stamping or punching.*

Q. Will Antisep A. P. Base clean readily from the work?

A. *Yes, in any mild alkaline cleaning bath, emulsion cleaner tank or standard degreaser.*

Q. Will Antisep All-Purpose Base save me money?

A. *Yes—mixed with water, it costs between 6 and 8 cents per gallon, depending upon the dilution. Compare that with your 22 to 45 cent straight oils!*

For answers to any further questions, prices and application data, write E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pa.

* HOUGHTON'S
ANTISEP
All-Purpose
CUTTING BASE

IMPROVED APPEARANCE!
BETTER PERFORMANCE!
COSTS REDUCED 25%!

Reasons why another
COUPLER HOUSING switched to
UNITCASTINGS!

This warehouse trailer coupler housing is subjected to considerable stress and strain in handling materials for general factory use. As a weldment, it not only used 40 inches of welding, slowing down unit production, but lacked eye appeal.
After the switch to Unitcastings, production costs dropped 25%, trailer performance improved, a streamlined appearance added more "saleability" to the product . . . and with an eye to future repeat orders, Unitcastings created better customer relationships. To build quality into your own product, trust it to UNITCASTINGS—they're better.

UNITCAST
Corporation
QUALITY STEEL CASTINGS

Give us a chance to offer a "cast steel" answer for your parts problem. Our suggestions while your product is in the design stage will pay continuous dividends. Write or call today. Unitcast Corporation, Steel Casting Division, Toledo 9, Ohio. *In Canada:* Canadian-Unitcast Steel, Ltd., Sherbrooke, Quebec.

UNITCASTINGS ARE FOUNDRY ENGINEERED

clude a self-centering stacking cap and a towing hook which keeps the racks even when in long trains.

Equipment Mfg., Inc., 21550 Hoover Road, Detroit 5, Mich.

(MORE DATA? CIRCLE FYI 88, p. 157)

Oil-water emulsion (tripoli composition) is claimed to have excellent cutting qualities with an unusually high coloring ability. Acme 2-L-177 is recommended for maximum cut and 2-L-178 for cut-color on such materials as brass, die castings and aluminum.

Hanson-Van Winkle-Munning Co., Matawan, N. J.

(MORE DATA? CIRCLE FYI 89, p. 157)

Production slide rule is made of vinylite-plastic rigid sheet that is resistant to machine oils and most chemicals, and will not warp or support combustion. A green signal shows if productivity is above standard expectancy of 100%; a red signal when productivity drops below 100%.

R. G. Bock Engineers, Lincoln National Bank Bldg., 1951 Irving Park Road, Chicago 13, Ill.

(MORE DATA? CIRCLE FYI 90, p. 157)

Fluorescent lighting system for slimline and 40-watt bipin lamps, called Strip-Line is available in seven different types. It has a panel depth of less than 1 in. making it possible to use this system in limited space.

Benjamin Electric Mfg. Co., Desplaines, Ill.

(MORE DATA? CIRCLE FYI 91, p. 157)

Oilproof enamel, known as No. 32, dries to hardness in eight hours. For electrical service, it has a dielectric strength of 800 volts per mill. It is also claimed to have excellent resistance to oils, moisture, chemicals, abrasive dust, greases and water.

Irvington Varnish and Insulatar Co., 6 Argyle Terrace, Irvington 11, N. J.

(MORE DATA? CIRCLE FYI 92, p. 157)

Spiral-blade hacksaw set that consist of three blades and a pair of holders. Spiral blades are said to permit sawing in any direction, since all sides of the blade can be used. Price for set—$1.

Dock's Tools, 2160 Sunset Blvd., Los Angeles, Calif.

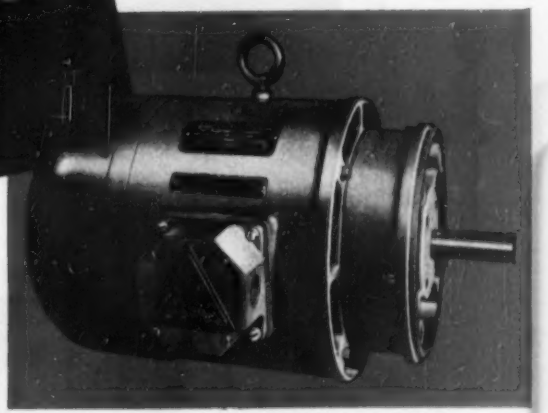
(MORE DATA? CIRCLE FYI 93, p. 157)

Grease for open-gear service is claimed to be extrement tenacious and highly adsorptive in character. Known as No. 32, it is supplied in

Introducing— 3 New

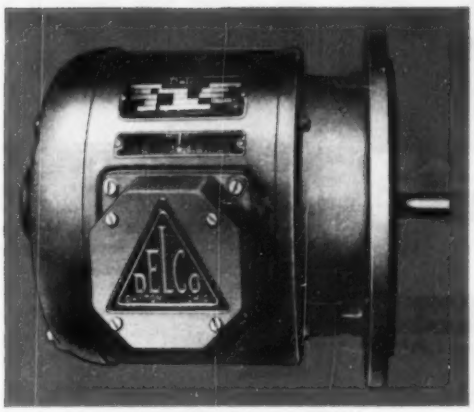
FLANGE-MOUNTED INDUCTION MOTORS by Delco

The recent addition to the Delco motor line of the three flange-mounted integral motors here pictured extends Delco's range of usefulness in the industrial field. The phrase "Delco Preferred" will now appear on motor specifications for machine tools, pumps and other classifications with even greater frequency than before.



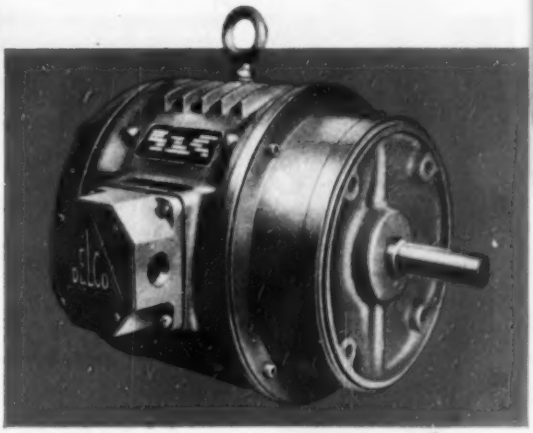
TOTALLY ENCLOSED FRAME FAN-COOLED BALL BEARING SQUIRREL CAGE INDUCTION MOTOR

Shown with C type flange. Available with C or D type flange, through 365 frame.



OPEN FRAME BALL BEARING SQUIRREL CAGE INDUCTION MOTOR

Shown with D type flange. Available with C or D type flange, through 365 frame.



TOTALLY ENCLOSED FRAME NOT FAN-COOLED BALL BEARING SQUIRREL CAGE INDUCTION MOTOR

Shown with C type flange. Available with C or D type flange, through 254 frame.

DELCO MOTORS

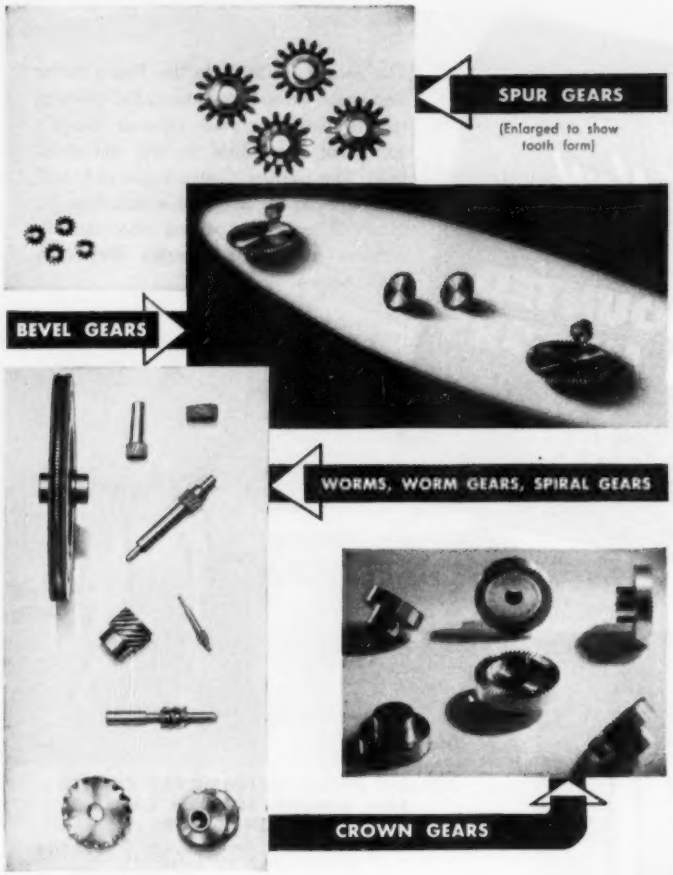
DELCO PRODUCTS

Division of General Motors Corporation, Dayton, Ohio

New and interesting—"MOTORS ON PARADE"—a 16 mm sound film now available for group showings. Write Delco Products for full information.

DELCO DAYTON OHIO

Offices in Chicago, Cincinnati, Cleveland, Dallas, Detroit, Hartford, Philadelphia and St. Louis. Also available through United Motors Service branches.



HAMILTON No. 1 PRECISION GEAR HOBBER

(Capacity:—6" diameter of gear blank)

Install a Hamilton No. 1 Precision Gear Hobber and make your choice:—the same hourly production as formerly with far more precision, or the same precision as formerly with greatly increased production.

Ask for Bulletin H-1-49

A few **DEALERSHIPS** are still available.

THE Hamilton TOOL COMPANY

830 SO. NINTH STREET • HAMILTON • OHIO • U • S • A

cartridge form for a nozzle-gun applicator which ribbons the grease and often allows application while gears are moving. The grease has a melting point above 400 F, and retains plasticity with temperatures below freezing.

Keystone Lubricating Co., 21 and Lippincott Sts., Philadelphia 32, Pa.

(MORE DATA? CIRCLE FYI 94, p. 157)

Fractions can be quickly added or subtracted by using a circular scale. The device, known as the Fractionator, consists of three disks. The scale on the outer disk shows fractions in 1/32 increments; the inner disk fractions in 1/64ths. The center disk is dialed with a pencil point.

Charles E. Wells, P. O. Box 25, Montrose, Calif.

(MORE DATA? CIRCLE FYI 95, p. 157)

Fog-Free, a surfactant-silicon composition stops fogging and steaming of glasses. To use the chemical, the surface to be treated is cleaned, the coating applied, and finally, the surface polished with tissues. It is claimed that Fog-Free is non-toxic and invisible.

The Wilkins Co., Inc., Cortland, N. Y.

(MORE DATA? CIRCLE FYI 96, p. 157)

Shop locomotives, featuring a hydraulic drive, are designed to provide the smooth, uniform power of an electric drive, at far less cost. They are available in sizes up to 25 tons. The drive is said to save in engine wear because road-bed shocks are absorbed by the fluid coupling instead of being transmitted to the engine.

The Whitcomb Locomotive Co., Rochelle, Ill.

(MORE DATA? CIRCLE FYI 97, p. 157)

Silicone-rubber compound No. 161, can be fabricated more quickly and easily than previously developed silicone rubbers. The dielectric strength is only 170 volts per mil, but it retains all the other qualities of the silicone rubbers such as maximum resistance to extreme temperatures, weathering, chemicals, and oils.

The Stalwart Rubber Co., 218 Northfield Rd., Bedford, Ohio.

(MORE DATA? CIRCLE FYI 98, p. 157)

Portable conveyor handles small stampings, chips and granular materials. Working height is regulated through a 30-in. range by means of a

ROSS SPRINKLER MAKES AN ANNOUNCEMENT:

"We say -- without hesitation -- that the brass Anaconda supplies for these sprinkler heads gives us the best drawing performance and the lowest reject rate of any brass we've ever used".

This was no accident. The customer's equipment, together with the number and extent of draws, were carefully considered. Then a brass alloy of suitable composition and temper was supplied. Results were evident immediately.

How about those deep-draw jobs of yours? Any room for improvement? Want the benefit of our experience – without obligation? . . . Just write to The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: New Toronto, Ontario.

The Ross Sprinkler Company of Pasadena, California, in business since 1904, manufactures a broad line of Lawn Sprinkling Equipment and Air Conditioning Nozzles. Topmost illustration is full size; others indicate the extent of deep drawing required in producing the Ross No. 10 Solid Brass Hand Sprinkler

for better drawing brass

SPECIFY

ANACONDA®

first in copper, brass and bronze

SHIMS DO MORE
when they're made of
LAMINUM
THE SOLID SHIM STOCK
THAT P-E-E-L-S FOR ADJUSTMENT
LAMINUM shims look like solid metal—but actually they're made up of a number of .002" (or .003") layers of brass or steel. The laminations are bonded together, securely, over their entire surface. Yet they peel easily with a penknife.
They accurately adjust spacing in assembly
Save up to 30% in assembly time
No machining, grinding or filing required in fitting
No dirt or grit between layers
No counting or stacking loose, separate shims
All adjustments right at the job
It's easy!
We also make loose-leaf shims and packs of shims that are tack-soldered together. But in most cases, the LAMINUM shim is superior—and impressive in its overall economy.
MOST IMPORTANT!
We've been in the shim business for 37 years. Our large, modern plant in Glenbrook, Conn. has every facility to serve you, INCLUDING ENGINEERING SERVICE on this specialty of ours. Get in touch with us. No obligation, of course.
SEND TODAY for our free engineering data file and sample of LAMINUM
LAMINATED SHIM COMPANY, Inc.
3111 UNION STREET
GLENBROOK, CONN.
CUSTOM SHIMS
STAMPINGS
SHIM STOCK
AN-COR-LOK NUTS

double-screw center lift, and crank handle on conveyor facilities pitch adjustment from horizontal to a maximum of 45°. Portability is provided by two swivel and two stationary casters. Available in 4, 6, 8, 10, and 12-ft. lengths with belts 12, 18 or 24 in. wide.

May-Fran Engineering, Inc., 1677 Clarkstone Road, Cleveland 12, Ohio.
(MORE DATA? CIRCLE FYI 99, p. 157)

Draw bar, pump operated, is claimed to have the following advantages: pulls ½-in. to 4-in.-size conduit holes without manual exertion; eliminates danger of short-circuiting adjacent wire; will not warp, break, tear or distort metal. Thirty-pound pressure on handle produces 12,000-lb. pressure on cutting surfaces.

Patterson Equipment Co., Denair, Calif.
(MORE DATA? CIRCLE FYI 100, p. 157)

Socket wrenches—Addition of 20 single-hexagon (6-point) thin-wall socket wrenches to the PROTO line has been announced. Having thin walls, these sockets can be used in restricted areas where corresponding double-hexagon types will fit. Hex sockets are said to be stronger than 12-point types and therefore will wear longer.

Plumb Tool Co., Los Angeles, Calif.
(MORE DATA? CIRCLE FYI 101, p. 157)

Coping saw has a spiral blade which is claimed to prevent chipping or burring. The spiral blade permits cutting in any direction. Retail price is $1 with two extra blades.

Dock's Tools, 2160 Sunset Blvd., Los Angeles, Calif.
(MORE DATA? CIRCLE FYI 102, p. 157)

Compass, known as the Circle Master, has knee joints which can be quickly and easily adjusted to the various sizes of the required circle without altering the setting of the center wheel. The pencil holder is adjustable to all sizes of lead. The compass is available as a single unit or in complete sets.

Borden & Riley Paper Co., New York,
(MORE DATA? CIRCLE FYI 103, p. 157)

Roller coating machine coats any flat surface with oil, lacquer, enamel, or adhesive. The thickness of the coating can be precisely controlled by a simple adjustment, making possible coverage of up to 850 sq ft per gal.

Check Thread Accuracy... VISUALLY

WITH Hanson-Whitney *Precision* THREAD COMPARATOR

This precision instrument, expressly designed for production gaging, has proven itself since 1945 in checking all forms of threads including critical aircraft threads . . . and is now available to producers of external threads from 0 through 3⅛" diameter, coarse or fine pitches, in all classes. (Class 5 should be specifically requested.)

The indicator tells at a glance whether your product is over-size, undersize, eccentric, tapered, or if lead error exists. The work is recorded visually to accepted ring gage tolerances thus eliminating the human error-possibility of "feel".

Checking up to 20 pieces per minute . . . 3 minutes to change thread dia. units . . . means lower costs, greater flexibility, for both production and inspection departments.

FAST
ACCURATE
ECONOMICAL

1. Indicator is equipped with tolerance hands and is graduated in tenths of thousands. Any type indicator with ⅜" shank may be used.

2. Comparator easily set to desired reading by loosening knob and lowering indicator. Tighten knob screw to lock indicator in correct position.

3. Lever controls positioning of upper anvil. Can be easily raised or lowered to insert or remove work. This action eliminates excessive wear on anvils.

4. Comparator is easily set – insert setting plug, lower upper anvil. Set indicator at tolerance required.

5. Thread anvils are actually a split internal thread member to check assemble-ability and to give exact reading on indicator dial of part checked within .0002 accuracy. Anvil core hardened to 60-62 "C". Standard unit will check any P.D. from class 1 to 4 and only one set plug (of known P.D.) is required for all classes.

Standard recognized 2½ lb. pressure is maintained on work to hold it in reading position, eliminating human element while taking reading.

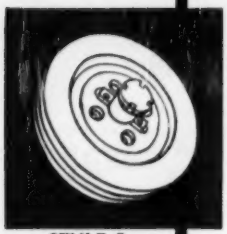
6. Complete gaging unit may be removed by loosening screw for change in size setting. Can also be used after removal for checking parts on machine. Complete removal and resetting accomplished in less than three minutes.

BULLETIN ON REQUEST

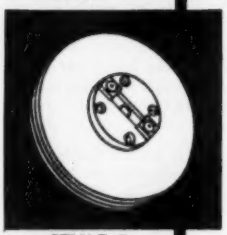
HANSON-WHITNEY COMPANY, HARTFORD 2, CONN.
DIVISION OF WHITNEY CHAIN COMPANY

Bulletin shows detailed various parts of the H-W Comparator (all available separately). Send for your copy today.

LOVEJOY Flywheels



STYLE 1



STYLE 2

STYLE 3

IMPROVE *milling cutter performance*

INCREASE *cutting blade life!*

You can increase milling production, improve accuracy and lengthen blade life by using Lovejoy Flywheels. Steel cutting is as smooth as silk, and other metals are usually cut easier and faster with the help of these patented Flywheels. One manufacturer reports a 10-time increase in blade life. Others report complete elimination of chatter with resulting improvement of surface finish. Still others have proof of reduced H. P. requirements.

Lovejoy Flywheels are available for mounting on the spindle of any machine . . . Style 1 for driving shell end mills; Style 2 for bolt-on mills; Style 3 for bolt-on or National Standard arbors.

The Lovejoy Flywheel Bulletin gives full details, specifications and prices.

Write for Details!

Lovejoy TOOL COMPANY, INC.

128 MAIN ST., SPRINGFIELD, VERMONT

of material. The coater will handle flat materials of any length and up to 50 in. in width and 1½ in. in thickness.

L. R. Wallace & Co., 440 Seaton St., Los Angeles 13, Calif.

(MORE DATA? CIRCLE FYI 104, p. 157)

Copper-brazed crankshafts, with components made on punch press and screw machine, can frequently replace drop-forge construction without sacrifice of quality and with substantial cost reduction. These shafts, hardened or unhardened, are made to customer's specifications.

Technical Metal Processing Inc., East 55th St., Cleveland 14, Ohio.

(MORE DATA? CIRCLE FYI 105, p. 157)

Portable saws said to cut faster than abrasive disks when sawing abrasive or plastic-composition materials. It is claimed that the carbide-tipped blade stays sharp 30 times longer than standard blades and loses less diameter in the resharpening process.

The Black & Decker Mfg. Co., Towson, Md.

(MORE DATA? CIRCLE FYI 106, p. 157)

Zinc-phosphate coating is used for anchoring paint to cold-rolled steel products. It can be applied with ordinary hand applicators such as a brush, or a paint spray gun. Under normal conditions, one gallon will cover approximately 500 sq ft of surface.

American Chemical Paint Co., Ambler, Pa.

(MORE DATA? CIRCLE FYI 107, p. 157)

Floor resurfacer can be applied over wood or concrete floors without using metal lath or roughening concrete. Made in two models: Rezilo for wood floors; and Steelhard for concrete floors.

The Monroe Co. Inc., Dept. R.S., 10703 Quebec Ave., Cleveland 6, Ohio.

(MORE DATA? CIRCLE FYI 108, p. 157)

Peg-rack conveyor, designed for the handling and protection of machined or polished parts. It is claimed to cut costs by bringing the machine operator his work properly positioned for fast handling.

Rack Engineering Co., Connellsville, Pa.

(MORE DATA? CIRCLE FYI 109, p. 157)

Respirator, goggle combination is recommended for protection against chemical splashes, spray, and light

Full Automatic Cycle

. . . enables one operator to attend two BARDONS & OLIVER HEAVY DUTY MILL TYPE CUT-OFF MACHINES

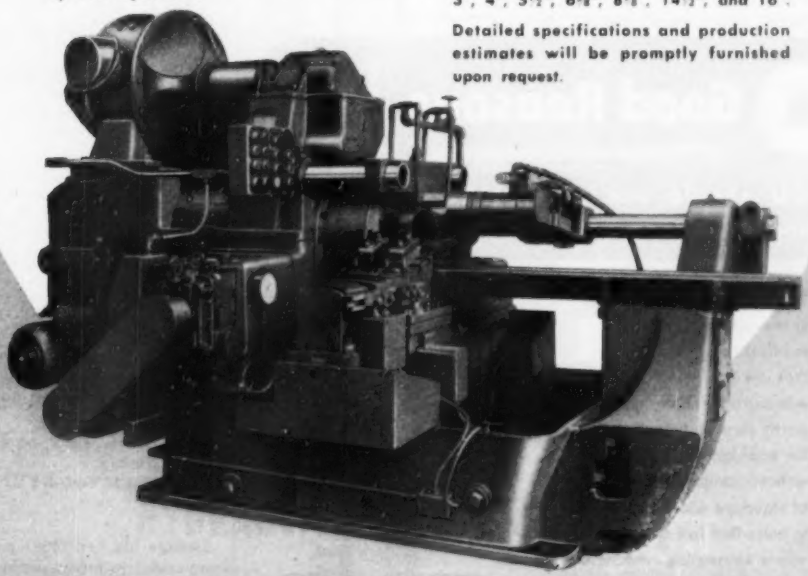
Increased output per machine is obtained because idle time is reduced to a minimum

Outstanding Features:

1. A variable-speed, direct current motor provides the proper cutting speed for each diameter and material.
2. Double (front and rear) Cut-off Slides have hydraulic rapid traverse, feed, and rapid return.
3. Two or more coupling blanks can be cut off at one time.
4. Machines can be made in pairs (left hand and right hand) for easier control by one operator.
5. Outside chamfering attachments are available and do not reduce the output of the machine.
6. A fully automatic loading table can be furnished to function in timed relation to the machine cycle. A continuous flow of parts is thus obtained with minimum effort.

Fully Automatic, Mill Type Cut-off Machines with the above features are offered in seven sizes, with maximum capacities as follows: 3", 4", 5½", 6⅝", 8⅝", 14½", and 16".

Detailed specifications and production estimates will be promptly furnished upon request.

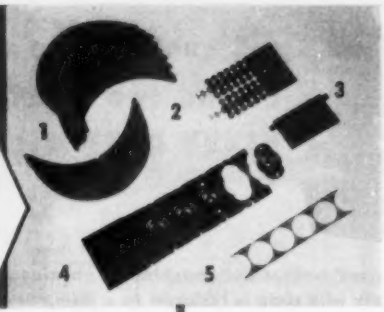


WE ALSO BUILD A COMPLETE LINE OF RAM AND SADDLE TYPE TURRET LATHES

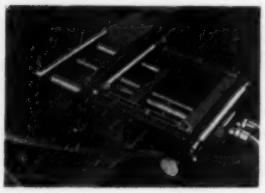
BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

Feedmaster
Automatic Air Feed
FEEDS THEM ALL
and switches jobs in minutes alone!



NO MORE TEDIOUS SET-UPS—just space stock guides, adjust jaw clearances and rotate micrometer dial to obtain exact stroke length; varies stroke in .001" increments. No wasted set-up time, no more slow costly hand feeding! Handles material from foil to two by fours! Costs only ⅓ usual price—IMMEDIATE DELIVERY! WRITE FOR DETAILS!



1) Feeds 12 layers of cardboard per stroke.
2) Feeds steel strip to piloted multi-stage die making thumb tacks.
3) Feeds slippery, oily nickel-plated steel to .002" without pilots.
4) Feeds steel through 4-stage die without piloting.
5) Feeds long thin fibre strips without pilots.

GREAT WESTERN TOOLS, INC., 3819 Riverside Dr., Burbank, Calif.

10 Good Reasons
why YOU should use NATIONAL Keyseating Millers on your next job

They will mill keyseats:

- in one cut.
- in offset holes.
- that are straight.
- with parallel sides.
- partly through holes.
- for interchangeable parts.
- without clamping the work.
- of standard width and depth.
- in holes that are closed at one end.
- where keyseating machine can't reach.

national
MACHINE TOOL CO.
CINCINNATI 22, OHIO

WRITE TODAY
for Catalog No. 16
complete, handy size

impact of foreign particles and exposures to fine dust. The goggles feature shatter-resistant replaceable acetate lens, while the respirator protects by means of cartridges or disk filters.

American Optical Co., Southbridge, Mass.

(MORE DATA? CIRCLE FYI 110, p. 157)

Power-outlet box makes possible the plugging in of eight standard Edison line-cord plugs from one outlet. Includes two fuses with fuse extractors, and a double-pole single-throw toggle switch which turns off both legs of all eight receptacles.

Sun Radio & Electronics Co., 122-124 Duane St., New York, N.Y.

(MORE DATA? CIRCLE FYI 111, p. 157)

Spray booths have a flood sheet which permits intake of paint-laden air through the water curtain. This is claimed to not only increase the amount of intake area, but also to assure more efficient intake because of more uniform air flow inside the enclosure.

Necomb-Detroit Co., 5741 Russell. Detroit 11, Mich.

(MORE DATA? CIRCLE FYI 112, p. 157)

Fittings, called Swagelok, provide a vacuum tight seal. Two ferrules and a threaded chuck inside the nut, clinch tight around the tubing wall. Recommended to overcome problems involving pressure, vibration and torque. Available in brass, monel, aluminum, steel, stainless steel and plastic. —*Crawford Fitting Co., Cleveland, Ohio.*

(MORE DATA? CIRCLE FYI 113, p. 157)

Screwdriver called Quick-Wedge, has a double spring-steel blade that holds, starts, and drives the screw. The blade is of high-carbon steel with a hollow-ground bit; the handle of shockproof Tenite II plastic. Available in 12 sizes.

Kedman Co., 233 S. 5th St., Salt Lake City 1, Utah.

(MORE DATA? CIRCLE FYI 114, p. 157)

Storage bin for small parts has 100 separate compartments. All are tilted forward to meet the eye and have rounded bottoms to make parts easier to pick out. Each compartment carries a tag holder. Another similar bin, the 320, has 320 compartments.

Service Parts System, 4607 St. Aubin St., Detroit, Mich.

(MORE DATA? CIRCLE FYI 115, p. 157)

PRODUCTION DOUBLED!

Another H-P-M Record at Harley-Davidson

Here's what a prominent motorcycle builder accomplished when he switched fender production to an H-P-M hydraulic—

—Operations reduced from 7 to 1!

—Production increased 100%!

—Scrap loss less than 1%!

With a buyers' market making competition tougher, why not give your production a lift? A switch to H-P-M press stampings will put the skids under high production costs. Here's how—deeper draws, faster cycle, fewer rejects, quicker die change-over, longer die life—all add up to greater profits for you!

Call in a nearby H-P-M engineer to study your production. Perhaps he can save you real money. Why not make a date today?

THE HYDRAULIC PRESS MFG. CO.
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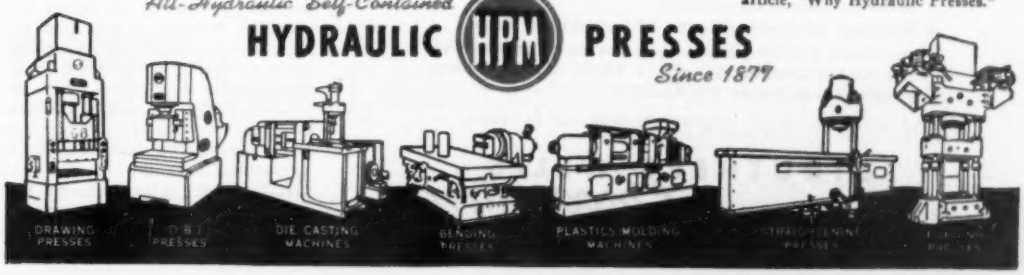
Write for your free copy of TOOL & DIE JOURNAL'S informative article, "Why Hydraulic Presses."

All-Hydraulic Self-Contained

HYDRAULIC HPM PRESSES

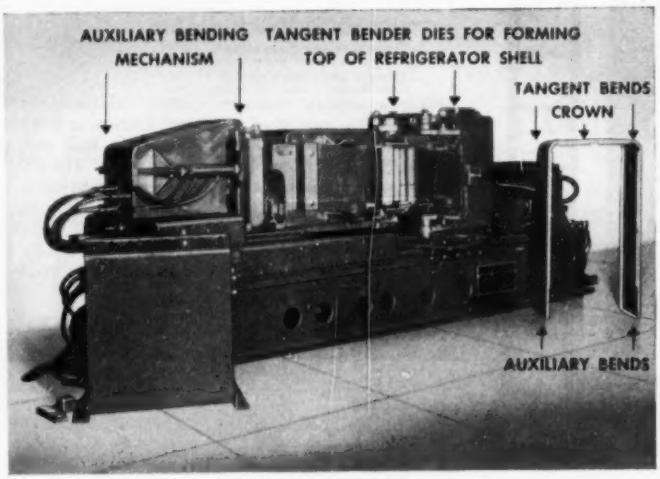
Since 1879



Here's a man who can show you

SHEET METAL PRODUCTION COSTS CAN BE CUT . . .

and provide a more saleable product


AUXILIARY BENDING MECHANISM
TANGENT BENDER DIES FOR FORMING TOP OF REFRIGERATOR SHELL
TANGENT BENDS CROWN
AUXILIARY BENDS

. . . and he can tell you about the new development for Double Wing Tangent Benders—the *Auxiliary Bending Mechanism* which folds the bottom during the Tangent Bending of the top.

- **This sizes the cabinets more accurately**
- **Saves the cost of extra handling and several sequenze press operations**
- **Average production up to 175 shells per hour**
- **Auxiliary Bending Equipment can be added to any present Standard Struthers Wells Double Wing Tangent Bender at the factory**

Phone, wire or write for informative, technical bulletins.

STRUTHERS WELLS Corporation

Machinery Division

TITUSVILLE, PENNA.

ROUND TABLE Discussion

WHO PICKS THE BOSS?

STRANGE ideas come to light and often in the strangest places. Possibly the idea of workers picking their boss is one that has merit and some day may be taken for granted in our land of free enterprise. However, today it seems a little too radical to be of any real value.

It cannot be denied that the thought of choosing the man you work for has its appealing side. Yet I wonder how long business would exist if it operated on the theory of putting men who had likable personalities into supervisory positions even if they were not qualified to hold the position. Perhaps a club president can get by if he is selected only on his good looks or ability to tell after-dinner stories, but we would not long have industry as we know it today.

Perhaps the radical would say it would be a good thing. Most any way to break down our industrial system is thought a good idea by the idealist who wants everything for nothing.

These people believe that if they could only run business as they would like, no man would ever have to work. Funny how employees think that because the boss expects eight hours' work for eight hours' pay that he is a hard taskmaster. These employees feel and are being taught day in and day out by unions that eight hours' pay today should be had for working only four to six hours.

Where, or where are our industrialists with their educational programs? Why not spend less on advertising and more on human relationship and the teaching of employees? Why not combat this ever onward march toward the overthrow of our free enterprise system? It can be done if business will only start a constructive program. Workers could have much more to say about running the business if they actually knew the problems that exist. How can a person learn about both sides of a question if only one side is ever presented? Oh yes, feeble attempts have been made to tell employees about business but who is going to pay attention to the one company president who talks in terms that are above the level of the average worker? Let's formulate a program which is down to earth. Let's talk

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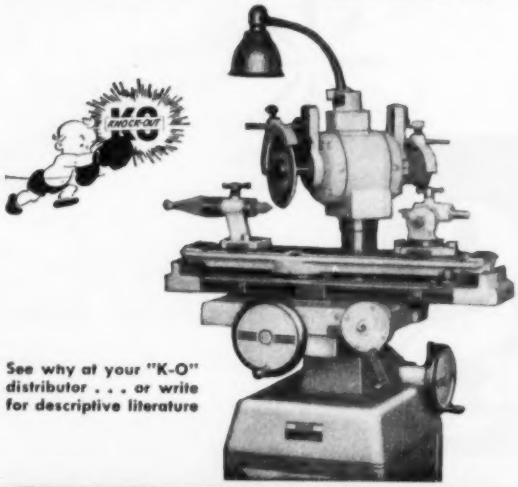

See why at your "K-O" distributor . . . or write for descriptive literature

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ABERDEEN, SOUTH DAKOTA

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Up to 30% HEAVIER

MODEL O Bench Model

PRESS-RITE
5 TON POWER PRESS
Compare it...
FEATURE FOR FEATURE!

- Heavy Uni-Cast Frame
- Greater Shut Height
- Open Back Inclinable
- Non-Repeat Single Stroke Safety Mechanism
- Automatic Cam Actuated Brake*
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$187.50
f.o.b. St. Paul, Minn. with standard equipment.

SEE your dealer or WRITE for bulletin 348 TODAY!

NOT JUST ANOTHER 5 TON PRESS

. . . but a 5 ton press loaded with the features of larger presses. You'd never dream that such performance is possible for only $187.50, f.o.b. St. Paul, Minn.

Try its many features. You'll agree that you've never had a press that matches it feature for feature.

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so that the janitor or sweeper can understand it easily and learn the lesson being taught. Then repeat it in many varied ways until it forms a thinking habit with the worker.

Ed really has been taken in if he believes that the boys are actually interested in his successor. It is a good method to entice a foreman into helping the union put across the point that the workers should have some say in who manages them. This is a first wedge for the union for gaining complete control of the company. Once the workers are allowed a voice in the choice of foreman they have established a precedent which will soon lead to the union's telling the company whom to hire and fire as supervisors.

The supervisors who are interested in seeing the company make money will be the first ones that the union will attempt to replace. It is these fellows who expect the worker to put out a day's work for a day's pay.

It is advisable to always think twice about plans presented by the union or union employees. They usually have two edges and the second edge is often worse than the leading edge. The only way employees today should ever have more to say is for industry to start educating them so that they can know how a business operates and can, therefore, constructively improve company operations.

Charles D. Townsend
West Hartford, Conn.

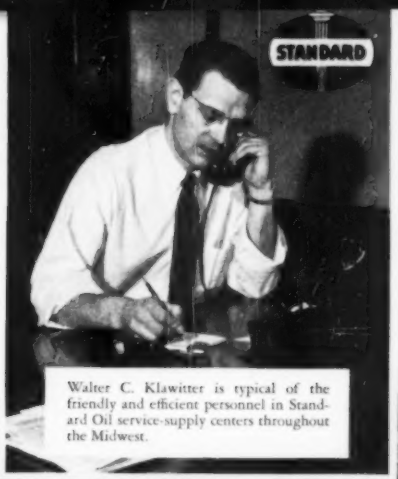
•

IT REALLY would not make too much difference who picked the supervisor, if a method could be found by means of which the best available man could be selected. Top supervision is likely to be prejudiced in one direction, workers in the other. Top management will be taken up with the idea of obtaining a man who is adequate and adaptable, while workers are liable to think more particularly of obtaining one who is appreciative and agreeable. However, all these attributes should be as well balanced as possible in the man selected.

It is extremely difficult to find a really workable method, however, by means of which workers may be allowed to select their own supervisor and still obtain the best available man for the position. Challenge yourself to find a group of men among whom there are not those who feel they could do a better job of supervising than the present boss. There is that about the human spirit which causes most men (if not all)

(Continued on page 194)

Easy local call . . .



Walter C. Klawitter is typical of the friendly and efficient personnel in Standard Oil service-supply centers throughout the Midwest.

3 IMPORTANT ADVANTAGES

Standard Oil's Lubrication Service is especially geared to serve your midwest operations.

1 Service-supply points are near your plant. You are assured of fast deliveries, prompt lubrication engineering service.

2 Lubrication specialists have been specifically trained in Standard Oil Lubrication Engineering Schools to help you obtain the maximum benefits from lubricants and fuels.

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Fast local delivery

• Anywhere in the Midwest; a simple, local phone call will bring you any petroleum product you need—double-quick! Here's why: a services-distribution set-up—unique in the oil industry—has a Standard Oil office and warehouse located practically in your own backyard! Adequate stocks of the lubricants and fuels required for the efficient operation of your plant are warehoused at that service-supply center. You can always get the product you need—*when* you need it—delivered right to your door.

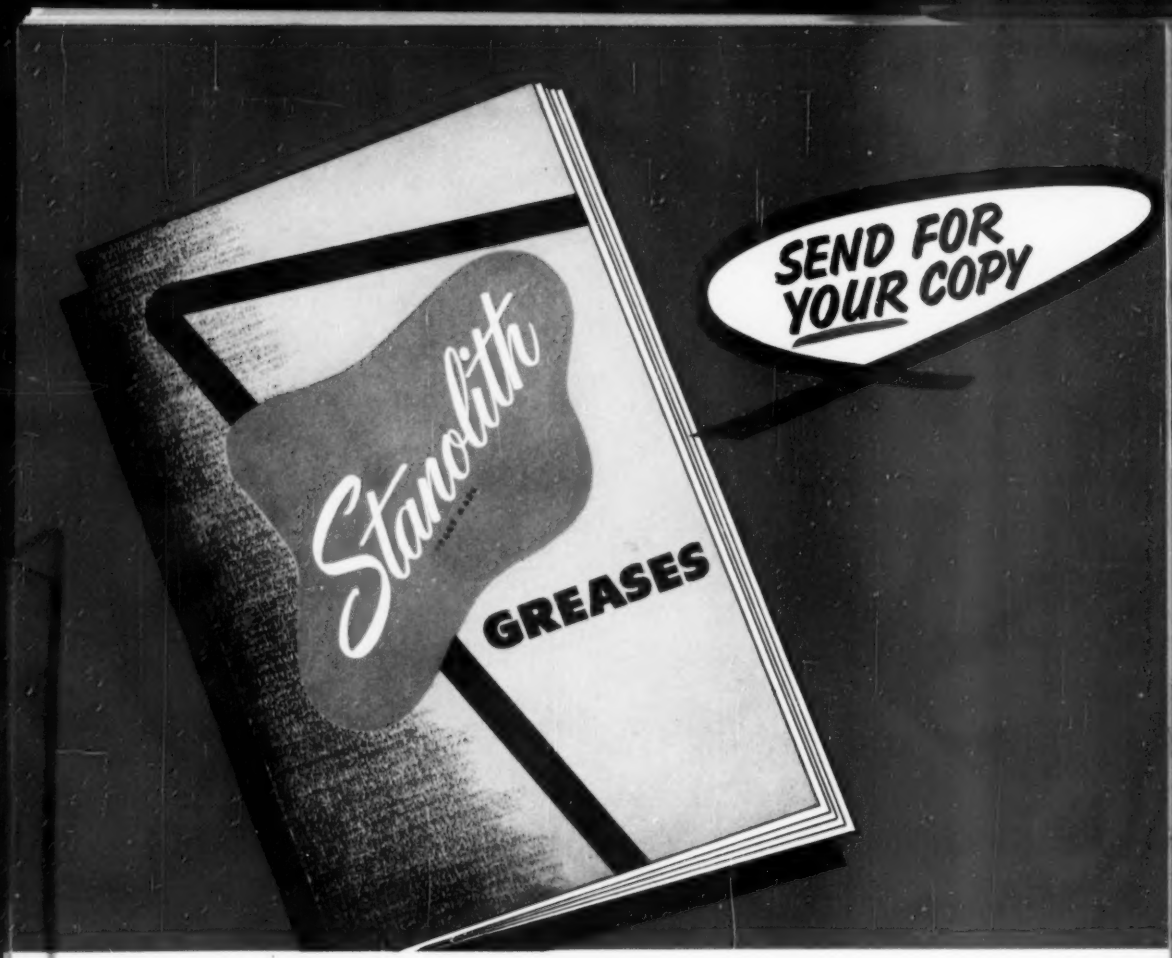
Here, too, are the local headquarters for a Standard Oil lubrication specialist. He is close at hand, will give you on-the-spot engineering service. He has plenty of practical experience. He has been specially trained for his job in a Standard Oil Lubrication Engineering School. He is backed by Standard Oil's extensive research and technical facilities.

Let this lubrication specialist and Standard Oil's efficient supply service help you make real savings. Phone your local Standard Oil (Indiana) service-supply center* today.

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

***Service-supply centers are located throughout: Colorado, Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Montana, Missouri, Nebraska, North Dakota, South Dakota, Oklahoma, Wisconsin, Wyoming.**

STANDARD OIL COMPANY (INDIANA) STANDARD



Here's help for bearings in "HOT WATER"

New booklet tells how STANOLITH Greases solve wet-hot problems

HOW TO LUBRICATE bearings which operate under extremely wet conditions, and at the same time, are subjected to high temperatures? If that is one of your problems, the booklet illustrated above holds the solution.

It tells you about the outstanding qualities of Standard Oil's new STANOLITH Greases. It explains why these lithium soap products—unlike soda soap or lime soap greases—will withstand *both* heat and water. The booklet contains evidence of this ability. It gives actual case histories of some of the many different jobs on which STANOLITH Greases have eliminated troubles caused by high temperatures, presence of steam or water, and high speeds. It also describes successful low-temperature service.

Study this wide range of applications. Discover how the two grades of STANOLITH Grease not only can solve difficult lubrication problems but can save you the cost and trouble of stocking and using a variety of special greases. Send for this information. Write for your copy of the STANOLITH booklet today. Simply address your letter to:

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NOW "STUBBY" a shorter *WORKSAVER*

it's a YALE *WORKSAVER* electric truck

FOR NARROW AISLES

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FOR HIGHWAY TRUCKS

STUBBY OUTSIDE
STURDY INSIDE!

Squeezing through narrow congested areas is a cinch for "Stubby." Here's why: "Stubby" is 6 inches shorter than other Worksaver models. But it's cut down in length only . . . all the efficient qualities standard in Yale Worksavers are part of "Stubby," too! "Stubby" Worksavers can be had in pallet or platform lengths to suit your exact needs . . . in 4,000 and 6,000 lb. capacities.

Only "Stubby" Worksavers have *all* these advantages:

1. ***Operational Controls On The Handle.*** Dual controls . . . right or left-hand operation for two forward and reverse speed travel. Push buttons for elevating and lowering . . . dual control warning signal.

2. ***Power-packed Drive Unit*** has improved motor efficiency.

3. ***"Dual-Lift" Mechanism*** . . . new . . . better. Combines 2 hydraulic lifting cylinders with articulating connection to lifting linkage.

4. ***Easy Steer*** . . . widely separated tapered roller load bearing and 16" diameter, ball bearing steering ring with built-in, self-aligning features. Greater than right angle turning in either direction.

5. ***Positive Acting Safety Brake*** effective instantly with handle in either upright or horizontal position.

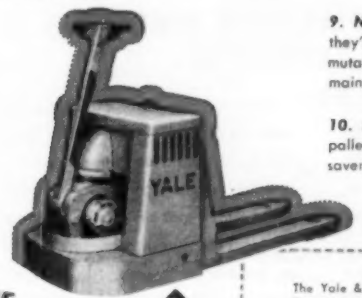
6. ***Dual Trailing Wheels*** in each fork of pallet truck provides wide floor contact . . . easier turning . . . greater floor protection.

7. ***Large Diameter Drive Wheel*** has more rubber . . . cleated treads for better traction and longer wear.

8. ***Double Battery Protection*** . . . batteries assembled in steel case . . . fit in Worksaver's totally enclosed heavy steel battery compartment.

9. ***No Flexing Of Electrical Wires*** . . . they're fed into handle controls from commutator at fulcrum point. Eliminates breakage, maintenance . . . reduces fire hazard.

10. ***Spark Enclosed Features*** available on pallet and platform type "Stubby" Worksavers.



"Stubby's" 6 inch shorter length comes in handy in tight spots.

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Please send me:

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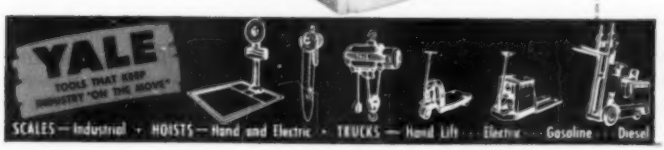
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TOOLS THAT KEEP INDUSTRY "ON THE MOVE"
SCALES—Industrial • HOISTS—Hand and Electric • TRUCKS—Hand Lift • Electric • Gasoline • Diesel

Tool Maintenance Costs CAN Be Controlled!

Here's Proof from RHEEM MANUFACTURING CO. Chicago, Illinois

• In the Kedzie Avenue plant of the world's largest manufacturer of automatic water heaters, thirty-nine Buckeye Air Tools — screwdrivers, drills, wrenches, belt sanders and grinders — are in constant use on busy production lines. During the past four years, maintenance cost, including repair parts, for all these tools has averaged less than one dollar per day—*approximately 2 ½ cents per day per tool!*

How about tool maintenance costs in your plant? Chances are, there's an opportunity to make substantial savings in maintenance time and expense, not forgetting that less maintenance means greater productive output, too. Whenever you like, we'll be happy to show you just what Buckeye Tools can do in your plant — there's no obligation, and you'll be the sole judge . . . fair enough?

Buckeye Tools CORPORATION
DAYTON 1, OHIO

Portable Air and Electric Tools for Industry

to think more highly of themselves than they ought to think, and the result is the envy and jealousy which we find in practically all places. This being the case, it is almost imperative that top management shall be arbitrary, at least in a very great measure, in the selection of supervisors.

Even where management is arbitrary in the matter of insisting that all appointments to supervisory positions, whatsoever, shall be made from men already working in the plant, many beautiful friendships have been sadly marred. Joe gets the post that Bill has long felt should be his, and Bill can never quite forgive. Too, Bill usually has a following. On this basis, management quite often goes outside for a new supervisor, even though it is realized in advance that the bunch in the department will be plenty sore temporarily. Anything that may be done on the sly to limit the efficiency of the new supervisor has already been foreseen and allowed for; he is given a generous span of time by top management to get his feet on the ground and to find his way around both technically and psychologically.

It is unfortunate that men in general have their morale affected every time a new supervisor must be appointed, but it seems to be one of the inevitables except in those rare cases where there is a man in the department who is clearly head and shoulders above everyone else with reference to both ability and popularity that his appointment is really expected by everyone. If a man could be found who really has a practical solution to this age-old problem, he would be worth his weight in gold in any sizable plant.

Whatever the problems with regard to particularities in any given case, it must not be forgotten that the ability of a supervisor to obtain hearty and loyal cooperation from workers cannot be considered of less value than technical know-how and teaching ability. None of these factors may be dispensed with, and the nearer they are in true balance, the better. Before a real job can be done in any department, production-wise, both the supervisor and his men must not only know *how* to do it; they must also really *want* to do it.

John E. Hyler
Peoria, Ill.

•

WHILE it might be some satisfaction to some of the workmen in a shop to have some say in the selection of their foreman when a change is made, it is likely that the majority

NOW *RESISTANCE SPOT WELDING*

(TO AN-W SPECIFICATIONS)

• WITH this one welder you can weld the widely divergent metals listed above simply by changing control settings. Designed to weld aluminum to Army and Navy specifications, its ability to handle a wider range of thicknesses permits welding many aircraft components including primary structural members. Because it welds faster and will handle a wider range of work than any previous resistance welders, it produces at lower cost and can be amortized more quickly. Quality of welds is unsurpassed.

The patented Sciaky Three-Phase System uses up to 75% less current than single-phase welders and operates at approximately 85% power factor, making it practical even where power facilities are limited. Write for details today.

SCIAKY BROS., INC.
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SCIAKY
SAY "SEE-ACKY"

NEW SCIAKY SERIES PMCO2ST Three-Phase Modu-Wave Welder

100 KVA at 50% duty cycle
220 and 440 volt 3-phase, 60 cycle*
Standard Throat depth 36"

Welding Range to AN-W specifications (2 thicknesses): aluminum and magnesium alloys .025" to .081"; stainless steel .022" to .109"; low carbon steel .022" to .156".

* Available with special controls for 25 and 50 cycle.

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Complete details, description of controls, features, specifications are included in Bulletin 134-ST. SEND FOR YOUR COPY TODAY.

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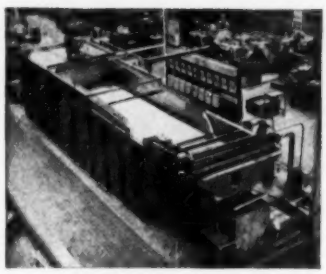
Keeps Coolant Automatically Clean

Hoffman CLARIFICATION EQUIPMENT
selected for production
of improved earth movers



CENTRAL SYSTEM—In tooling-up for production of its new "Cat" DW 20 Tractor and DW 21 Prime Mover, the Caterpillar Tractor Co. *centralized* clarification of soluble oil coolant in a Hoffman dual Model 66 Flotation Unit. At the Peoria, Ill. plant of Caterpillar, this unit serves 26 grinding machines, with a present maximum flow rate of 500 g.p.m. The installation saves time and labor usually required for cleaning of individual sumps. Better quality control and longer productive cycles between wheel dressings are provided. Solid impurities are automatically aerated out of coolant and removed in near-dry state . . . no strainers to change.

PROVED PERFORMANCE—Decision to install Hoffman equipment was based on earlier experience with Pressure Filters and a Model 36 Flotation Unit. These items, shown at left, have been used since 1947 for machining on "Cat" engine cylinder liners. The three I-805 pressure filters serve five honing machines with mineral seal coolant. The flotation unit delivers soluble oil coolant at maximum flow rate of 90 g.p.m. Hoffman Filtration Engineering Service will assist with technical information and recommendations for your coolant problems.

SEND FOR BULLETINS . . FREE SURVEY!

FILTRATION DIVISION U.S. HOFFMAN MACHINERY CORPORATION
211 LAMSON STREET, SYRACUSE 6, N. Y.
CANADIAN PLANT: CANADIAN HOFFMAN MACHINERY CO., LTD., NEWMARKET ONT.

choice would be someone that they thought would be easy with them.

While work should be made as simple and easy as possible it must be finished accurately to the standards required and as speedily as is consistent with quality.

Management of course is responsible for results and is in the best position to make selections of those in charge of minor affairs due to their position in the organization, and usually their acquaintances and general knowledge of men in general.

However, any recommendation from the shop employees should be given very careful consideration if suggestions are offered and their findings reported to their superintendent before a final decision is made.

The above procedure should be followed in all cases regardless of where the recommendation comes from.

Management has much more at stake than the workmen, yet it is good for the workmen to feel that their welfare is given due consideration, neither shop or office should be influenced to make a selection other than for one who is fair minded and capable.

No favoritism or trickery should ever be countenanced; such procedure is sooner or later sure to crop out.

Abel Blakeman
Watervliet, N.Y.

•

TELEVISION EYES

IF IT is definitely known that Thompson is in trouble, Ed is certainly overlooking a good bet in refusing to talk to him or to have him talked to about the matter. If and when a man is suffering from frustration, or if a worry-cycle has become established in his thinking, he is helpless in his inefficiency. He cannot readily "snap out of it," as Ed seems to think. Countless men have been caught in a mental trap of this kind. Once they have been shown the way out of it, they are far less liable ever to be trapped in this way again. Too, they generally have a feeling of enduring friendship for the one who has helped them. Still further, a man who has thoroughly recovered from a neurosis is usually efficient in helping other men to pull themselves out of the dumps.

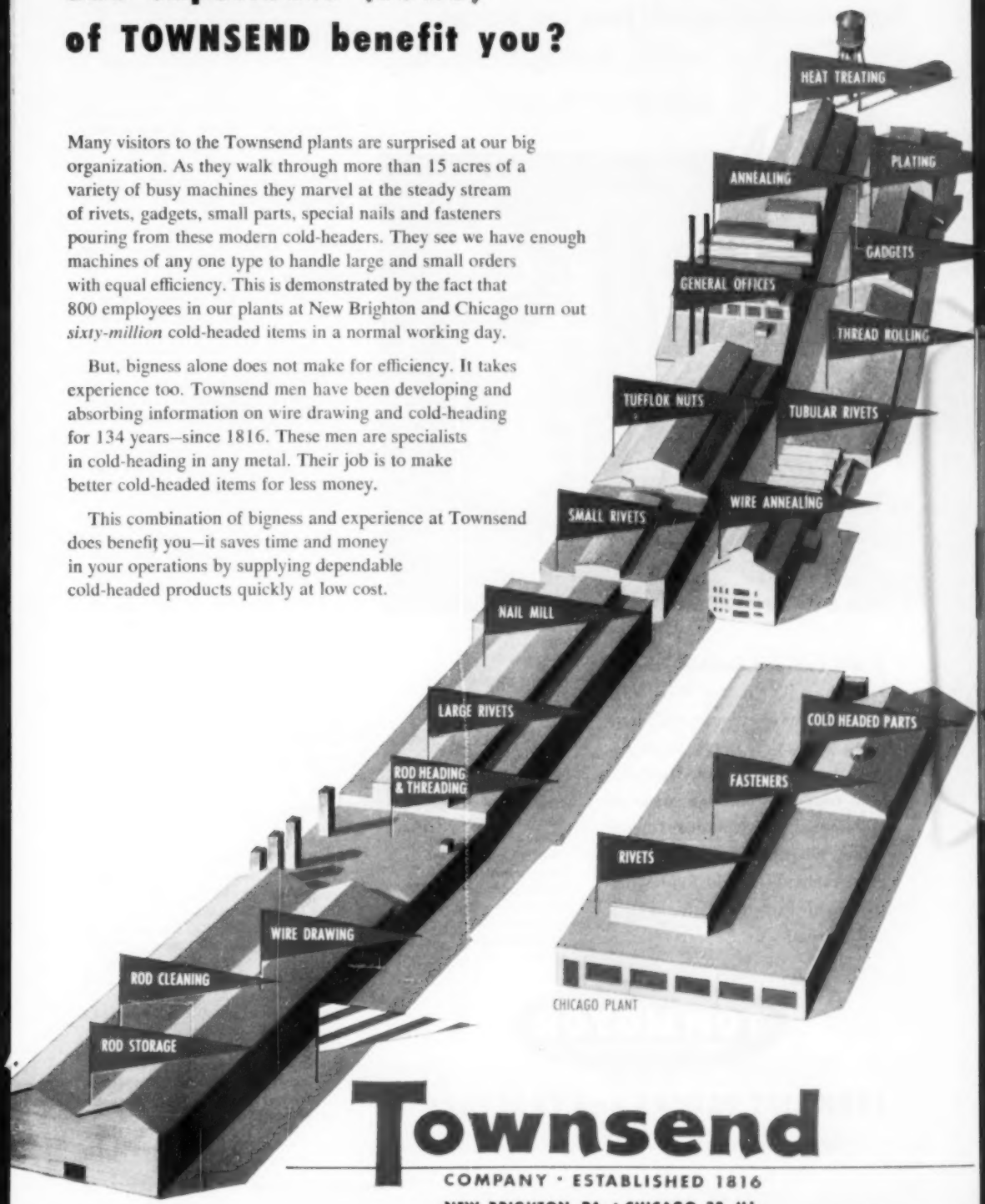
Over against this, there are some men who admittedly are exceedingly difficult to help, and some who refuse to be helped. There is no answer but to let such a man go. The time may come when a good psychiatrist will be recognized as a necessity in the

How does the size (BIG) and experience (LONG) of TOWNSEND benefit you?

Many visitors to the Townsend plants are surprised at our big organization. As they walk through more than 15 acres of a variety of busy machines they marvel at the steady stream of rivets, gadgets, small parts, special nails and fasteners pouring from these modern cold-headers. They see we have enough machines of any one type to handle large and small orders with equal efficiency. This is demonstrated by the fact that 800 employees in our plants at New Brighton and Chicago turn out *sixty-million* cold-headed items in a normal working day.

But, bigness alone does not make for efficiency. It takes experience too. Townsend men have been developing and absorbing information on wire drawing and cold-heading for 134 years—since 1816. These men are specialists in cold-heading in any metal. Their job is to make better cold-headed items for less money.

This combination of bigness and experience at Townsend does benefit you—it saves time and money in your operations by supplying dependable cold-headed products quickly at low cost.



Townsend

COMPANY • ESTABLISHED 1816

NEW BRIGHTON, PA. • CHICAGO 38, ILL.

Extra help on toughest Mass Handling jobs.
Extra man-hours saved. Extra fast moving, loading, stacking, transporting.
Extra profit for you!

It will cost you nothing extra to learn how Towmotor *Mass Handling* makes every materials handling job easier, faster, safer. For complete information, write for your copy of "Handling Materials Illustrated." Towmotor Corporation, Division 56, 1226 E. 152nd St., Cleveland 10, Ohio. Representatives in all Principal Cities in U. S. and Canada.

Arrange now for a private showing of this 30-minute sound movie on Materials Handling. See how Towmotor effects startling reductions in production costs. Ask for complete details at no obligation.

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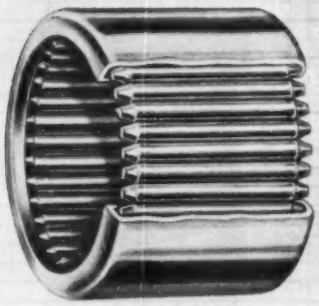
personnel department. Even now they are given some recognition, and some firms maintain a plant chaplain, knowing full well that pre-occupation, worry, and lack of efficiency are very often the bedfellows of actual guilt, or of a guilt complex. A specialist is really indicated, for upon the accuracy with which a man's real trouble can be appraised depends the degree of competency with which he may be helped out of his mental turmoil. There must be understanding and sympathy, or the job can never be rightly done. It would be better for a man like Ed not to try it personally, because his natural feeling in the matter would defeat his purpose, but Al could probably do a reasonably good job.

A good method of approach is to gently let a man know that his efficiency has been on the down grade to the point where it commands continual and unfavorable attention, and that it is realized he is having a degree of mental trouble sufficient to prevent him from showing his old degree of form and fitness in production. He should be gently told that this situation is inevitably placing his job in jeopardy, but that the firm nevertheless stands willing and ready to help him in any way that will allow him to regain mental poise, and consequently the necessary degree of efficiency to stay on the job. Then, if he shows any disposition whatever to open up, the promised help should be forthcoming as far as appears consistent. Let Ed hoot about a department of domestic relations if he will; it is far better than a lot of production wreckage inevitably following upon unnecessary employee turnover. And production aside, it is something less than humanitarian to withhold help that might easily and profitably be given to any man.

There is an old African proverb: "The full-bellied child says to the empty-bellied child, 'Be of good cheer'." The lines have fallen in pleasant places for Ed, in consequence of which he is utterly unable to sympathize with Thompson. Let his own domestic tranquility be disrupted to the point where he is in real trouble, and he will have a different argument for the balance of his life span. Granted that an industrial organization is not primarily a charitable institution, it is nevertheless a structure much dependent on the human element, and therefore one in which a reasonable amount of charity pays huge though often unrecognized dividends.

John E. Hyler
Peoria, Ill.

a stickler for accuracy



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Torrington is a stickler for precision from design to finish in making Needle Bearings. Rollers centerless ground to tenths of thousandths, with accurately machined ends . . . retaining shells drawn to precise dimensions . . . carefully controlled heat treatment . . . fine surface finishes—these features assure smooth operation.

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A New High
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■ New precision standards, longer life, easier operation, fool-proof action—they're features of the new Ettco-Emrick *Keyless* Drill Chuck.

There's no slipping, no damaged drill shanks—the grip is always tight and true. Yet only a slight twist of the chuck body is needed to release the drill.

You need a chuck that's tops in simplicity and design. Save time! Save money! Ask your Industrial Distributor for the new Ettco-Emrick Keyless Drill Chucks and Shanks.

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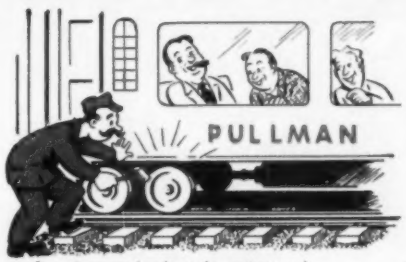
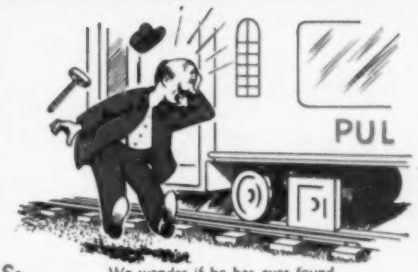
☛ *Fully described in bulletin #7.*

TAPPING TECHNIQUES No. 9



Sometimes we laugh at the patient zeal
Of the man who "taps" the Pullman wheel!

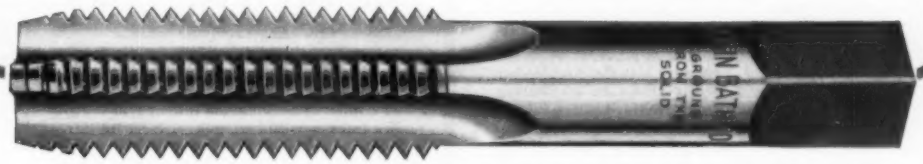


We wonder if he has ever found
A wheel that's square instead of round!

JOHN BATH CO. INC. · WORCESTER · MASS ·

We know **our** rigid test for taps
Would make **him** laugh — and call us saps!

Yet we both work for your protection
Since both our "taps" must pass inspection!



INSIST ON BATH TAPS . . . PROFIT BY THEIR PLUS-PERFORMANCE

Bath "ground from the solid" Taps are precision cutting tools and as such are subjected to the most rigid inspection. Accuracy, hardness, flutes, chamfering . . . all these important qualifications must pass pre-determined Bath laboratory standards. Here, a constant check is kept on raw materials, heat treating and every step of manufacture. Bath technicians continually use the most modern research facilities to assure the superiority of Bath Taps for longer wear, higher speed and greater production. If you are having threading difficulties, we will be glad to help you select the right tap for your job.

PLUG AND RING THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

JOHN BATH CO. INCORPORATED
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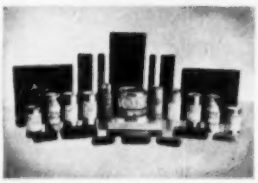
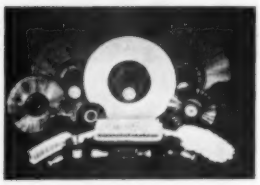
Always know what you're getting when you buy plating and polishing equipment & supplies



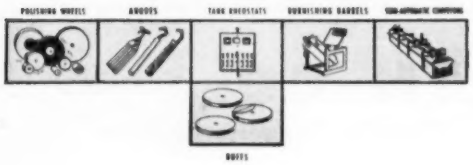
Be sure you are getting the benefit of laboratory composition research. The H-VW-M laboratory is constantly engaged in research to improve the cutting and coloring properties of all types of buffing compositions. 6-B-97, an exceptional stainless steel cutting rouge, is the latest result of this program. It yields an exceptional degree of color along with deep cut found only in the use of coarser abrasives.

Oil-water emulsion liquid tripoli compositions are also available for spray gun application on automatic buffing machines. Deepest cut is obtained with 2-L-178, while the best color is left by 2-L-177. The latter is in the double-duty cut-color classification. Both are tripolis for use on virtually all non-ferrous metals. H-VW-M welcomes research opportunities on specific buffing problems.



Be sure the brushes you buy are right for trouble-free service. H-VW-M recommends StapLBond Tampico brushes for use with emery paste or other compositions for polishing irregular steel surfaces; with pumice or special compositions for satin finishes; for cleaning all metals. H-VW-M StapLBond Steel Wire Brushes are recommended for heavy brushing on rubber, castings, gear teeth and for removing scale, rust, etc., from metal surfaces. Brass wire brushes are used for brushed or satin finish on brass or copper. Stainless wire brushes prevent rusting and nickel-silver is used on non-ferrous metals other than brass or copper. The complete line of H-VW-M quality brushes in a full range of materials is described in Bulletin BR-104.

Be sure your plating conveyors are always ready for heavy duty. H-VW-M Full-Automatic Conveyors always are. Motors have variable speed drives; rugged carriers have self-lubricating fingers for heavy current loads; electrical circuits provide for inside auxiliary anodes; periodic reverse type plating is provided for as well as motion plating for uniform deposits of required thickness. Result? A marked reduction in rejects, lowered costs, a better product. H-VW-M is the most experienced builder of automatic plating machines in the world. Why not consult our engineers or write for Bulletin No. FA-103?



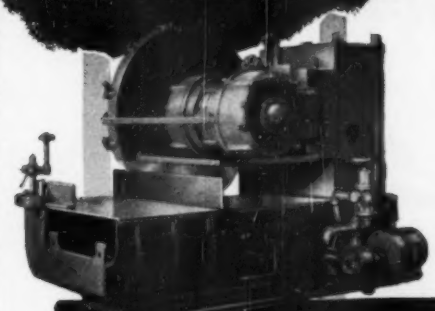
Yes, be sure you know what you're getting . . . and be assured you can always get what you want from H-VW-M when you want it . . . H-VW-M products are strategically warehoused for prompt service and delivery . . . H-VW-M sales-engineers and laboratory technicians are always available for help in your production problems. It is this overall service and experience that have made H-VW-M *the central source of supply . . . for over 80 years . . . for all the needs* of the electroplating and polishing industry.

HANSON-VAN WINKLE-MUNNING COMPANY, Matawan, N. J.
Plants at: Matawan, N. J. • Anderson, Indiana • *Sales Offices:* Anderson Chicago • Cleveland • Dayton • Detroit • Grand Rapids • Matawan Milwaukee • New Haven • New York • Philadelphia • Pittsburgh Rochester • Springfield (Mass.) • Stratford (Conn.) • Utica.

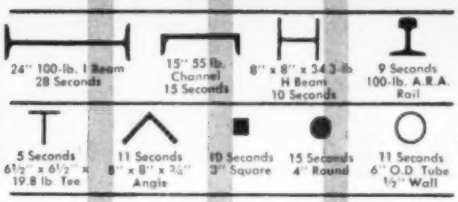
H-VW-M

Manufacturers of a complete line of electroplating and polishing equipment and supplies

Modern Sawing



with **KLING** *HIGH SPEED FRICTION SAWS*



Friction sawing is one of few mechanical processes which employ the heat of friction in a useful manner. It concentrates heat on the material to be severed at a rate which is faster than it can absorb heat. The immediate temperature rise of the contact surface is so great that its strength is reduced considerably lower than that of the colder blade rim. This heated surface is readily removed by the blade and permits complete severing of the material rapidly with no loss of metal from the blade.

Because of its versatile ability to cut many varied structural shapes, as well as solid or hollow bars in any sequence, without change of blade or set-up, one machine can handle a volume of cutting that would otherwise require several separate shears or slow speed saws.

Consult Kling engineers regarding your metal cutting problems. State size of material to be cut. Bulletin No. 9200 giving full particulars and suggestions as to the type and size of saw will be mailed promptly. No obligation.

KLING BROS. *Engineering Works*

Punches; Bar, Angle and Rotary Shears; Combination Shear, Punch and Copers; Plate and Angle Bending Rolls; Heavy Duty Grinders

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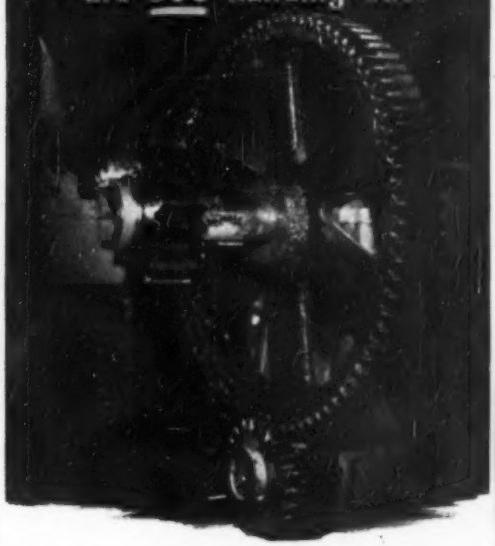


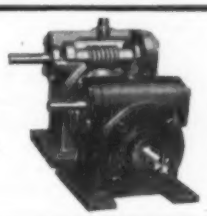
Dust? . . . dirt? . . . vibration? . . . sudden load changes? . . . 24-hour operation?

It takes a *good* gear to stand up under the tough punishment found in industry today. And Grant — thanks to over 70 years of experience — makes *only* good gears. So when you're faced with a really tough gear problem — call on Grant for a fast, economical solution.

Grant Gears are made in standard and custom types from ¼" to 72" in diameter. Hundreds carried in stock at all times. Send prints or specifications for quick quotation.

Look to Grant for *gear units*, too . . .

. . . hundreds of types and sizes available from stock — write for bulletin



Grant GEAR WORKS INC.

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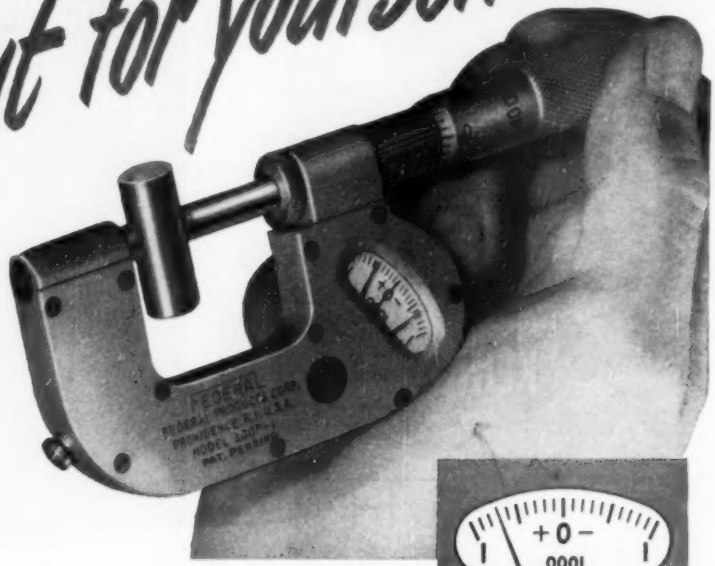
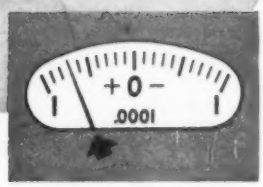
Find out for yourself....





why people who try it buy it!

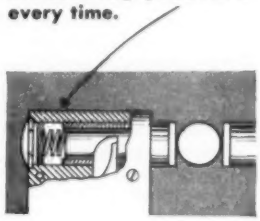
You've used regular "mikes" for such a long time you'll be amazed at the downright accuracy and plain honest-to-goodness convenience you can get with this CONSTANT PRESSURE, INDICATING MICROMETER. Just try it and you'll know why so many are buying it!

You'll discover the Federal MIKEMASTER has more worthwhile advantages than any other micrometer. It's the first really new micrometer made in this country in years. Once you've used it you'll recognize its superior accuracy — and you'll appreciate the convenience of reading an indicator instead of barrel graduations. You'll see how easy it is to check out-of-round and taper, too. You'll find its "repeat" accuracy matches some of your laboratory gages even though it sells for so much less money.

You'll also be pleased with the usefulness of the pushbutton Retracting Anvil and the Tolerance Hands when measuring duplicate parts. You'll find extra value in the *lapped*, Tungsten Carbide Anvils — and you'll just naturally like its nice balance and its *rust-proof*, dull chrome finish.

You don't have to take our word for it. Find out for yourself. Ask to see the Federal MIKEMASTER . . . and to try it on your work. Write to Federal Products Corporation, 1211 Eddy Street, Providence 1, R. I.

You'll appreciate the convenience of reading the Indicator instead of barrel graduations. The *constant pressure* of the anvil means constant measuring pressure every time.



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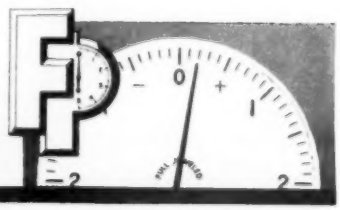


McCROSKY

Jack-Lock® CARBIDE TIPPED MILLING CUTTERS

Cut Cost On and Off the Job

● Standard McCrosky JACK-LOCK Milling Cutters are soundly engineered according to principles of milling and of chip disposal developed and tested in actual operation. JACK-LOCK Cutters can be depended on to remove metal efficiently and to match in rugged construction the power potential of modern machines.

Two exclusive McCrosky features make reconditioning of a cutter a short job. JACK-LOCK wedges—which hold the blades positive and rigid when the cutter is in operation—can be locked and relocked quickly and easily. Adjusting screws behind the blades permit fine and uniform adjustment to provide the very minimum of carbide needed to regrind the cutter to size.

The combined advantages of these two features make the upkeep of McCrosky cutters outstandingly economical:—each set of blades will yield the maximum number of regrinds; the down-time for reconditioning the cutter is greatly reduced; fewer duplicate cutters are needed to keep a production run in continuous operation.

Standard McCrosky Carbide Cutters provide individual designs for milling three different basic materials—cast iron, aluminum and steel—in a wide range of sizes. For complete details send for Bulletin No. 17-M.

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

COST CUTTING TOOLS

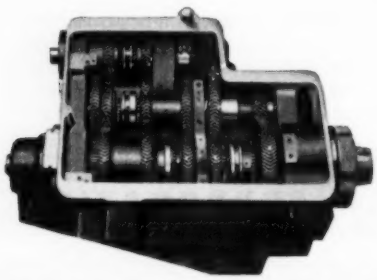
Designers and Manufacturers of

Jack-Lock Milling Cutters — *Super Adjustable* Reamers
Block Type Boring Bars — *Turret* Tool Posts
Wizard Quick-Change Chucks — *Special* Multiple Operation Tools

Tumbling Barrels . . to Resist Corrosion and Abrasion. These barrels are subject to extreme wear from small parts being cleaned by the swirling agitation of caustic solution and abrasives. For extra-long life, they are fabricated from wear- and corrosion-resistant Ampco Grade 8 sheet, carbon-arc welded with 5/32" Ampco-Trode 160 coated electrodes used as filler rods.

Ampco Extrusions available as solid rod and/or tube in rounds or simple shapes. From Ampco's own 2275-ton hydraulic press and extrusion mill. Their use saves metal, machining time, and costs. Superior grain structure and exceptionally high strength are assured — *plus* close tolerances and good surface finish.

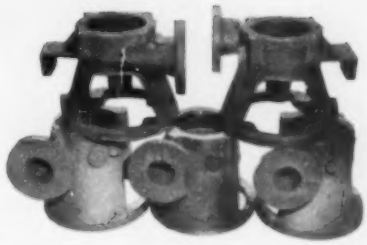
Ampco Metal Cam . . . for Smooth Action, Extreme Wear-Resistance. Ampco Grade 20 selected because it actually outlasts hardened steel with twice the Brinell hardness. This is due to its extreme wear-resistance and the smoother action of bronze against steel. Also ideal for rollers, gibs, slides, wearplates, forming dies on light-gauge steel and welding jaws.



Ampco Bushings on High-Speed Headstock . . . for High Wear-Resistance. There are 16 Ampco Grade 18 Bushings in this one headstock: 14 on loose-running gears, 2 on the center bearing of the intermediate shaft and main spindle. Ampco Grade 18 chosen as ideal alloy because of the heavy gear loads and high spindle speeds. Extra life assured by high tensile (77-85,000 psi), and Brinell hardness of 159-183.

Stock Bars of Grade 18 Ampco Metal . . . for Production and Maintenance where long life is important. Wear-resistant. Have exceptional impact and fatigue characteristics. Centrifugally cast to provide dense, fine grain structure free from impurities. Readily machinable. Ideal for bearings, bushings, gears, worm wheels, slides, guides and other wear applications. Available from stock in 12½-inch lengths from 2½-inch to 6-inch OD, or solid bars ½" to 4½" diameter, cut to desired lengths.

Paper Mill Rolls . . Wear-Resistant for Longer Service. Weight and wear are the usual problems in such rolls. Both were licked in this case — with Ampco aluminum-bronze. Centrifugally-cast Ampco Metal Grade A-3 provided a light, hollow roller — resistant to both wear and corrosion. Shaft and end-plates were cast of the same alloy and welded to the roller with corrosion-resistant Ampco Trode 10 electrodes.



Cast Ampco Metal Pump Bodies . . . for Corrosion-Resistance. Ampco Grade 12 selected for its high resistance to corrosion and wear (which is a special quality of all Ampco Metals). Grade 12 also has the advantage of quick, easy seating for valve and pump parts. Meets Federal specification QQ-B-671a, Class A, and Navy specification 46-B-18c.

AMPCO®

Equipment Life—Lower Costs with AMPCO Bronze Parts

Specify Ampco aluminum bronze for these unique, money-saving properties

1. High tensile strength
2. High compressive strength
3. High impact and fatigue values
4. Excellent bearing qualities
5. High "strength to weight" ratio
6. Resistance to wear and corrosion
7. Good retention of values at temperature extremes

It pays to use Ampco aluminum bronzes wherever you can. These long-wearing bronze alloys assure longer life and better service for almost any part — reduce maintenance and replacement frequency, cut downtime losses to a minimum!

First of all, be sure to specify Ampco bronzes for your own products. They're a mark of extra-quality which all buyers recognize. By the same token, look for Ampco bronze parts as a mark of extra-value in the equipment which you buy. And of course, use Ampco bronze replacements in your own plant maintenance to reduce downtime, service and repairs, and to insure low-cost, trouble-free operation.

Make Ampco Bronze Parts a "must" in every plan — product or production. That way you're sure of lower costs. Send for complete information today.

Ampco aluminum bronze and other Ampco copper-base alloys are available in a variety of grades to meet your exact requirements in any form you need: rolled sheet or plate, sand or centrifugal castings, forgings or extrusions, arc- and resistance-welding electrodes, and corrosion-resistant centrifugal pumps and plug valves.

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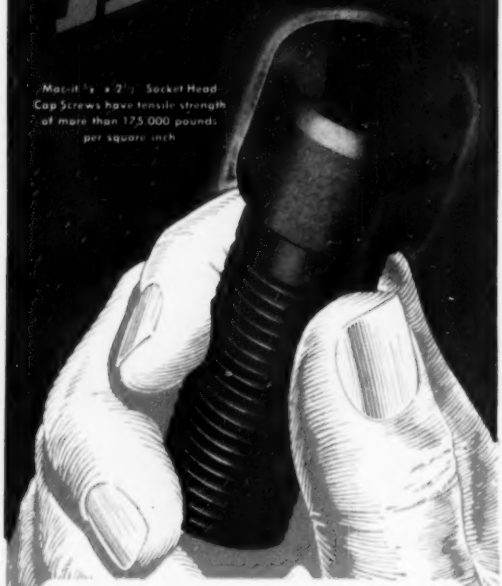
Mac-it ½ x 2½ Socket Head Cap Screws have tensile strength of more than 175,000 pounds per square inch



BETTER, FASTER SERVICE WITH THIS *COMPLETE* MAC-IT LINE!

Because many standard types of Mac-its are stocked throughout the country for quick delivery, and because specials can be engineered to your own specifications, you'll find it pays to investigate Mac-its *first.*

Mac-it's 35 years' experience in the manufacture of heat-treated, alloy steel screws is your assurance of precision, uniformity and strength. Sold through leading industrial distributors from coast to coast and in Canada. Write for new catalog today!

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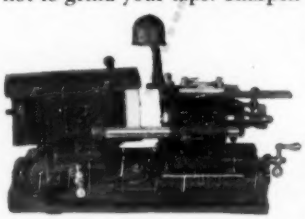
Blake TAP GRINDERS . . . increase Your Tap "Life Expectancy"

Now you can get full production from your taps and reduce breakage due to dull chamfers. Inexpensive Blake Tap Grinders accurately, economically, and *quickly* grind uniform chamfers on 2 to 10 fluted right or left hand taps. Only a few seconds are required to insert taps for grinding and no special training is necessary for operating. Here is the easy, sure way to increase your tap "life expectancy" and save many $$.

Remember, if you grind a drill, you can't afford not to grind your taps! Sharpen Up — (With a Blake Tap Grinder, of course).



Write for Bulletin 649A which tells about "Modern Tap Sharpening"

EDWARD Blake COMPANY

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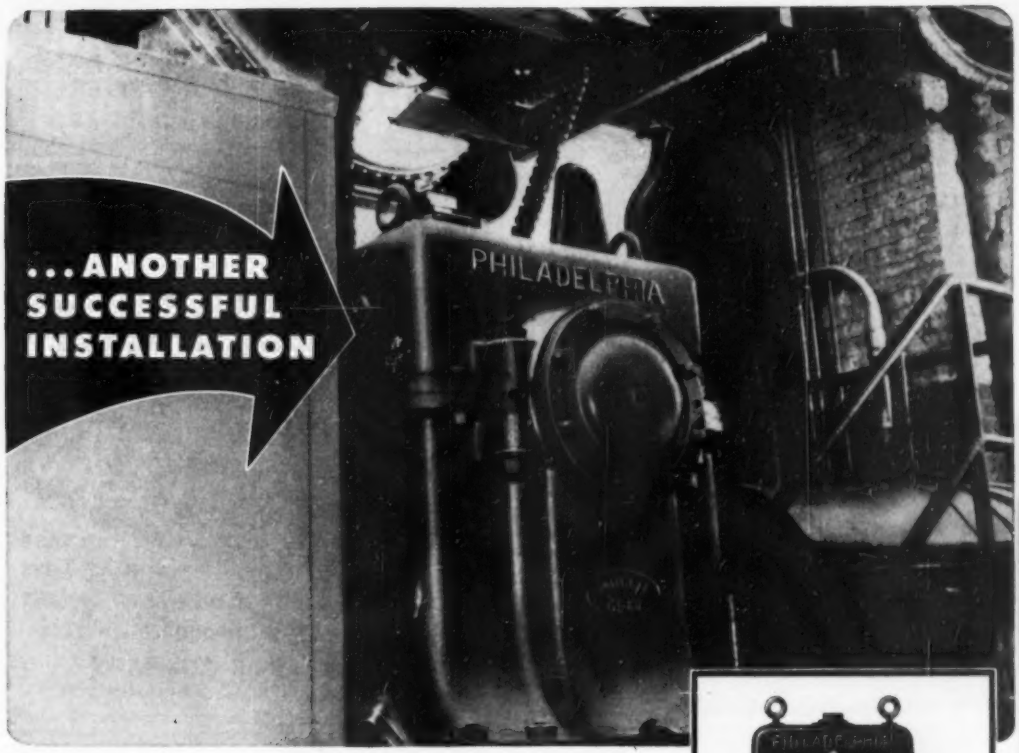
Black Diamond Precision Drill Grinders . . . Blake Tap Chamfer Grinders . . . Blake Flute Grinders . . . Waltham Cutter Sharpeners . . . Waltham Thread Milling Machines . . . American Tool Holders . . . Surface Finish Standards.

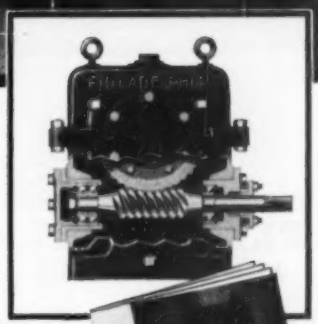


This Philadelphia Worm Gear Reducer driving a mixer in a Sugar Refinery

Indicating the wide adaptability of Philadelphia Worm Gear Units, is this installation of a Type AX unit in a molasses distillation plant, driving a mixer through an overhung chain assembly.

Philadelphia Worm Reducers are built in all types and in a full range of sizes and reduction ratios, for vertical or horizontal drives. All are scientifically designed, incorporating many important refinements which have been developed through our many years experience in meeting the varied drive requirements of all kinds of industries.

Every Philadelphia Worm Reducer is a custom made product, embodying standard fundamental principles, but having individual service characteristics that assure its performing the required job with maximum efficiency and economy and minimum maintenance.



Above is shown the worm assembly of a heavy duty Type AT unit.

Make the Philadelphia Worm Gear Reducer Catalog your guide . . . send for a copy today . . . on your Business Letterhead, please.

Philadelphia Gear Works, INC.

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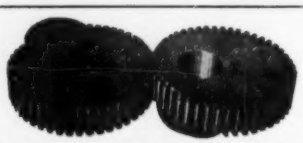

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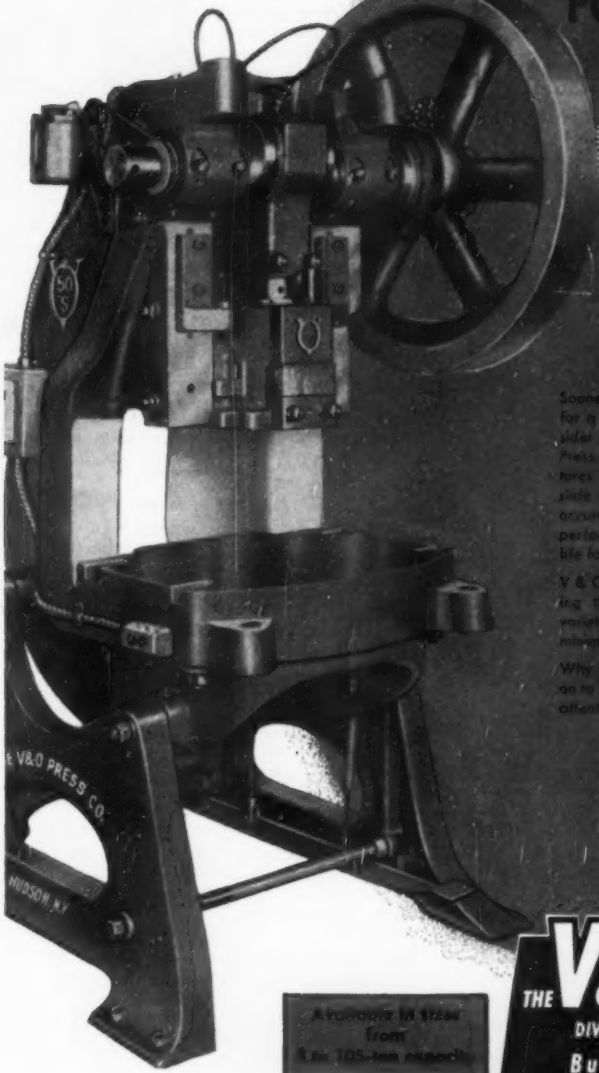

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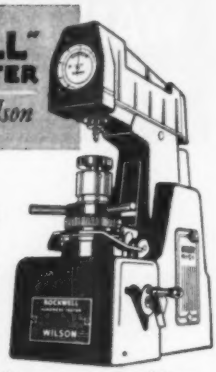

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WHAT'S THE FASTEST WAY TO CLEAN METAL? See page 11

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Oakite's New FREE Booklet

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answers many questions that mean better production, more profit for you. Just look at the table of contents:

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The Atlas Nicarb Process used for case hardening bushings and pins is one big reason for the stamina of Atlas "Super-Life" Chain. Nicarbing provides an outer surface strongly bound to the core of the steel which provides greater strength and wear resistance.

The link plates and rollers are also made of tough, heat-treated alloy steel; their uniformity achieved with automatic electronic instruments which control the furnaces.

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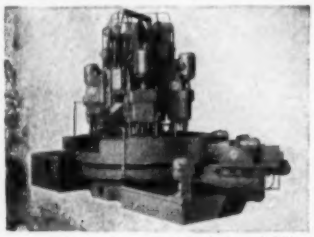
NEW! Mechanical POWER HEADS...

Help Maintain Production of 166 Pieces Per Hour — Lower Maintenance Costs

When you need high production with low unit and maintenance costs, consider the advantages of Roto-Matics. In this case the Roto-Matic is a station-type machine with indexing table. Drilling and reaming both suspension and king pin holes in front suspension support arms are performed at the rate of 83 pairs or 166 pieces per hour.



General view of drilling and reaming machine equipped with new Roto-Matic mechanical power heads.

An outstanding new Davis and Thompson development incorporated in the design of this machine are the Roto-Matic mechanical, electrical power heads operated by screw feeds. Included among the safety features are overload release clutches on the feed screws. Six heads are used, three vertical and three horizontal. Lower maintenance costs are obtained through elimination of excessive servicing.

Machines similar to this can be designed to handle dissimilar operations in the same parts or one operation on continuous production. Investigate the profitable applications of Roto-Matics.

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IF you resent interruptions when you're busy, set the example by not interrupting others when they're busy. If you are careless with your men's privacy, you can expect them to be careless of yours.

PREJUDICE is usually blind ignorance. Sooner or later, the man who retains prejudices runs into trouble—and shows his inability to educate himself out of his narrowness.

Don't Wait to Fill that Important Production or Management Position

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The Bowser system shown above continuously filters all soluble cutting oil recirculated to 13 rapid-production lathes on which Zollner pistons are machined to precision tolerances. It removes all fine, floating chips and prevents scratches in the piston grooves.

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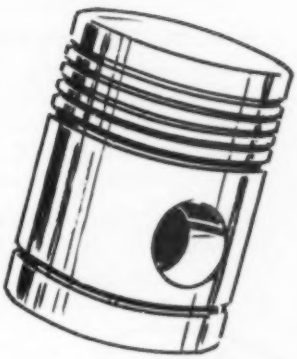
Since this system was installed by the Zollner Machine Works more than five years ago, machined surfaces have improved, scratches have been eliminated and rejections have been greatly reduced.

Tool life was also increased 10% to 15%; soluble oil consumption was reduced about 15%.

The system requires cleaning and a change of coolant only once a week. It pays for itself every six months.



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There's a Bowser cutting oil or coolant filter ideally suited for any metal-working requirement. Write today for complete information.

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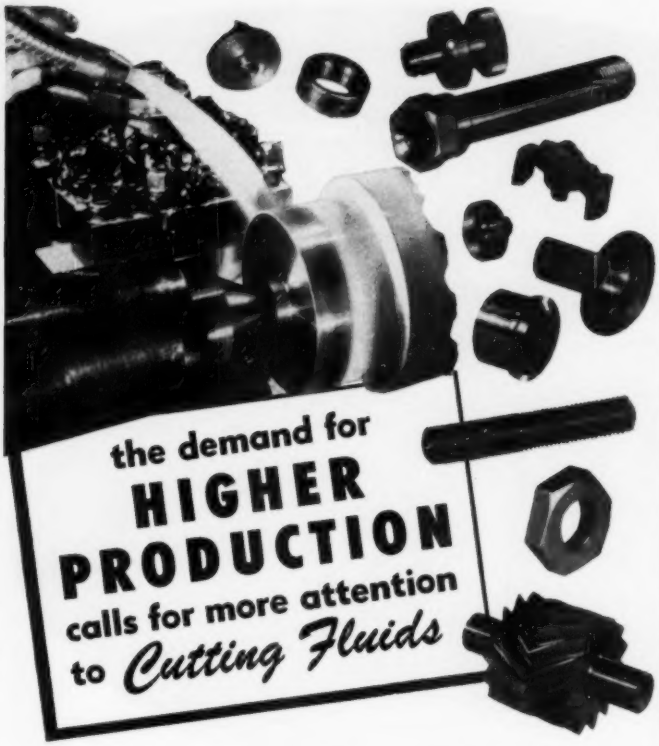

the demand for HIGHER PRODUCTION calls for more attention to *Cutting Fluids*

★ ***PRODUCTION INCREASED FROM 18 to 31 PIECES PER HOUR*** machining pipe union from 18-8 stainless steel in single spindle automatic *after* changing over to Stuart's THREDKUT 99.

★ ***SPEEDS, FEEDS INCREASED 50%*** turning, drilling, facing, reaming, tapping forged steel valve bodies (equivalent SAE 1315) on turret lathe after applying Stuart's SOLVOL water soluble cutting fluid concentrate. And, excessive scrap loss due to high finish requirements was eliminated.

★ ***PRODUCTION DOUBLED*** boring 7½" dia. hole through 11" dia. x 30½" long solid forged 5060 steel pump liner through use of Stuart's SPEEDKUT B the multi-purpose cutting fluid.

Our 85th Anniversary Year

• These are not isolated examples of how Stuart products and Stuart experience can help boost production. They are taken from daily field reports. Ask to have a Stuart Representative call. Send for your copy of "CUTTING FLUID FACTS," an interesting educational booklet.

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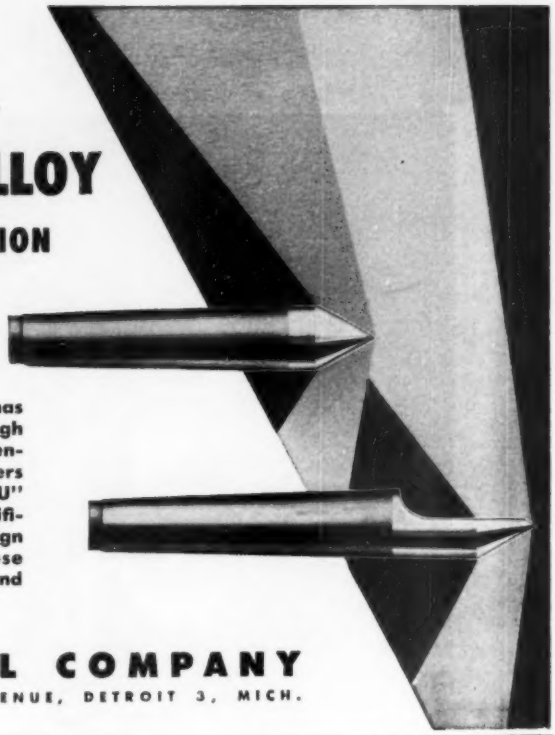

So superior is this alloy that *by actual test* it has shown results 3 to 10 times better than high speed steel and other alloy materials for centers. Standard "M-40-U" alloy tipped centers can be furnished from stock. Special "M-40-U" alloy centers can be furnished to your specifications, or our engineers will help you design special centers to fit your needs. Choose GORHAM "M-40-U" for top performance and long wear.

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GRAND RAPIDS No. 60

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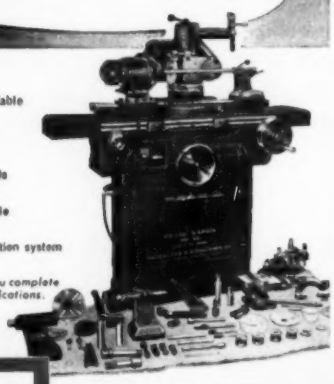

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Your letter will bring you complete information and specifications.

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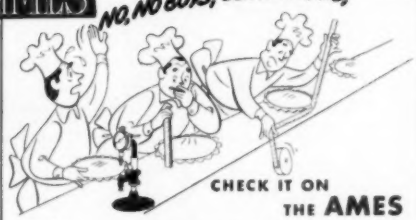

CHECK IT ON THE AMES

A cost conscious restaurateur actually employs an Ames Thickness Measure to hold pie crust thickness to a uniform standard, thereby cutting down raw material waste, lowering fuel costs and assuring top quality pastry day in and day out. This unusual solution to a measuring problem is illustrative of the creative thinking of Ames engineering and design department. They'll tackle any measuring problem you may have and come up with a sound answer that will improve your quality control. Ames has built gauges to measure the thickness of potato chips, soap flakes, enamel on teeth, as well as gauges that check the sway of buildings, the stretch of bolts plus many others that solve successfully unusual and difficult applications. If you are puzzled and want an economical answer to a measuring problem, send it to B. C. Ames today.

Ames No. 1 Dial Comparator — measures objects up to 2" in cross section. Adjustable table with positive locking screw. Height 9½", weight 4 lbs., Dial Indicator graduated .001", with .250" range.

Representatives in principal cities B. C. AMES CO. *Gordon Street, Waltham 54, Mass.*

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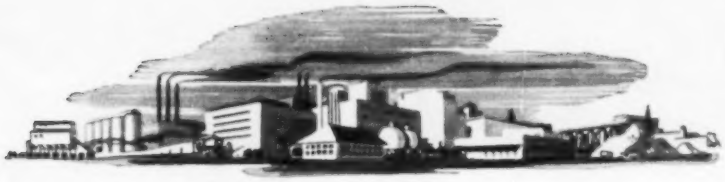

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It happened in Philadelphia, in a plant* where ten machines with 560 bearings were being lubricated by old-fashioned methods that wasted valuable production time.

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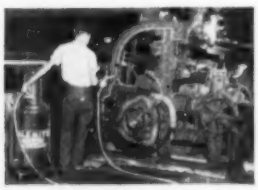

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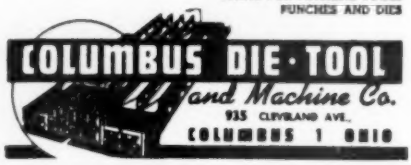

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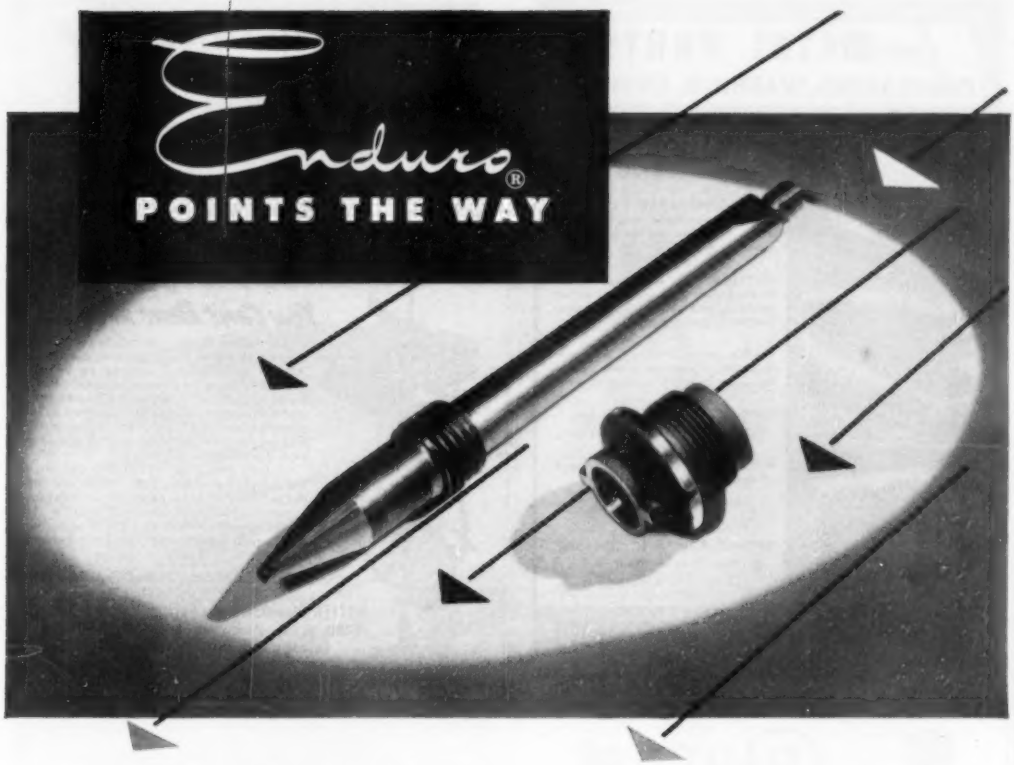

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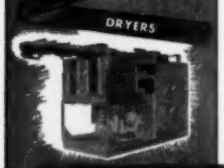
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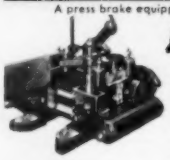

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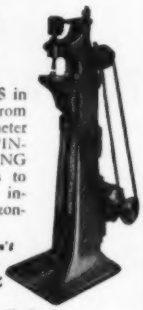

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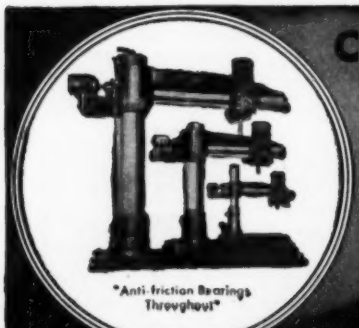

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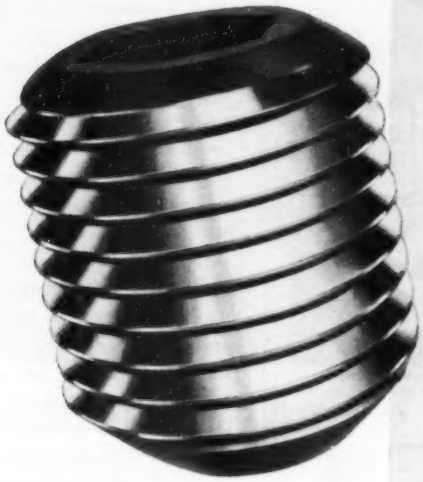

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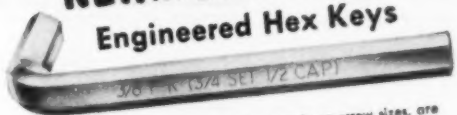

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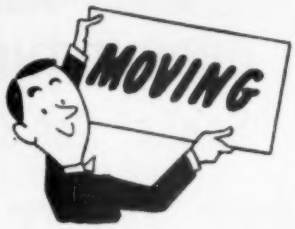
EVERY man should have some incentive—a better job, better pay, more time off, increased recognition, or some such. Why limit incentives to production workers? The staff and indirect men can perish of neglect just as easily.

WHEN you don't know, say so—and find out. Some people can get away with not knowing, but most of us can't. It's safer to confess—and find out. You may fool others for a time by fast talking, but you usually end up by fooling yourself.



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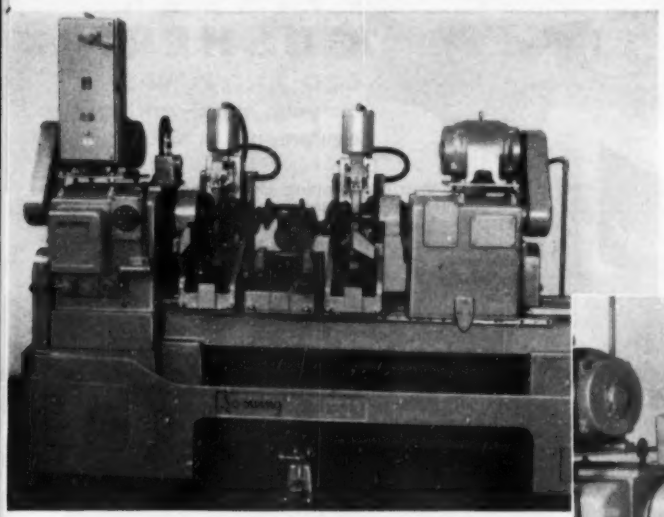
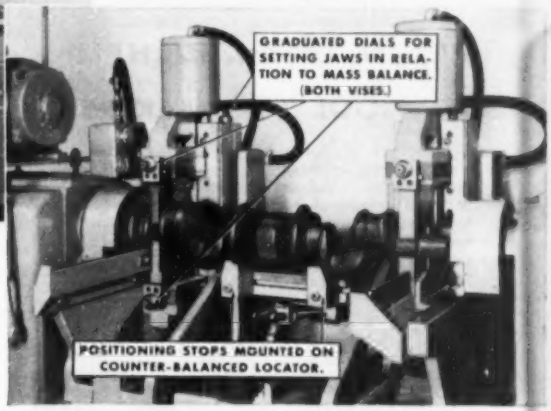


FIGURE 1. Vises are positioned vertically to facilitate loading and unloading heavy crankshafts.

FIGURE 2. Counter-balanced positioning locator stops raised against cheeks to position crankshaft for accurate depth of centers.


GRADUATED DIALS FOR SETTING JAWS IN RELATION TO MASS BALANCE. (BOTH VISES.)
POSITIONING STOPS MOUNTED ON COUNTER-BALANCED LOCATOR.

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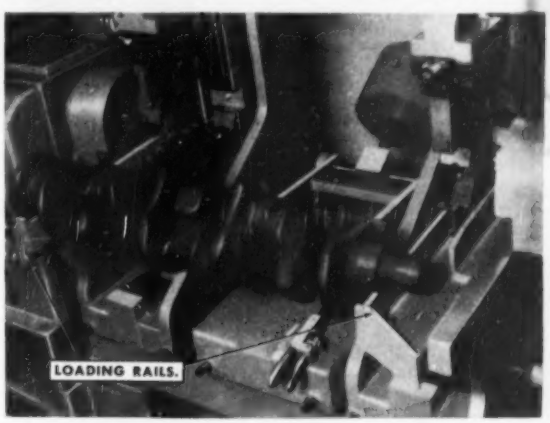
Solution: The Model "CS" Lo-swing Automatic Centering Machine selected for this job was equipped with vertically-designed air-operated vises, fitted with built-in loading rails. (Fig. 1).

In operation, the first crankshaft forging of the lot is centered with all jaw adjustment dials set at zero. The crankshaft is then centered and tested for mass balance in a balancing machine, after which fine adjustments are made on the vise jaws. The machine is now ready for a production run of a particular type of crankshaft. Depth of the two centers in relation to the cheeks is accurately maintained by the counter-balanced positioning locator stops shown in Fig. 2. With these vertically-positioned vises, the operator merely sets the crankshaft on the loading rails and pushes it forward until it drops into position in the open vise jaw. (Fig. 3)

Lo-swing engineers are at your disposal to assist with your handling and machining problems.

FIGURE 3. Vise jaws open to level of loading rails... no lifting required to remove crankshaft from vise jaws.



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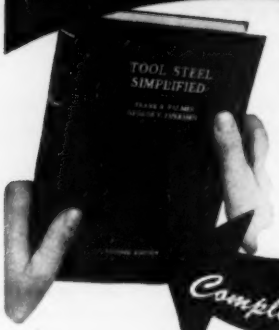

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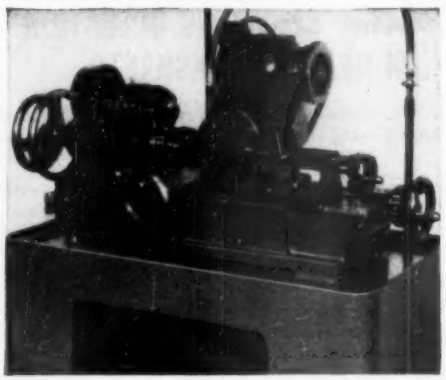

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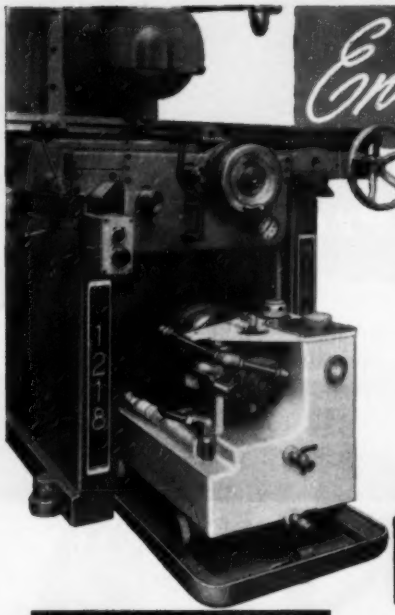

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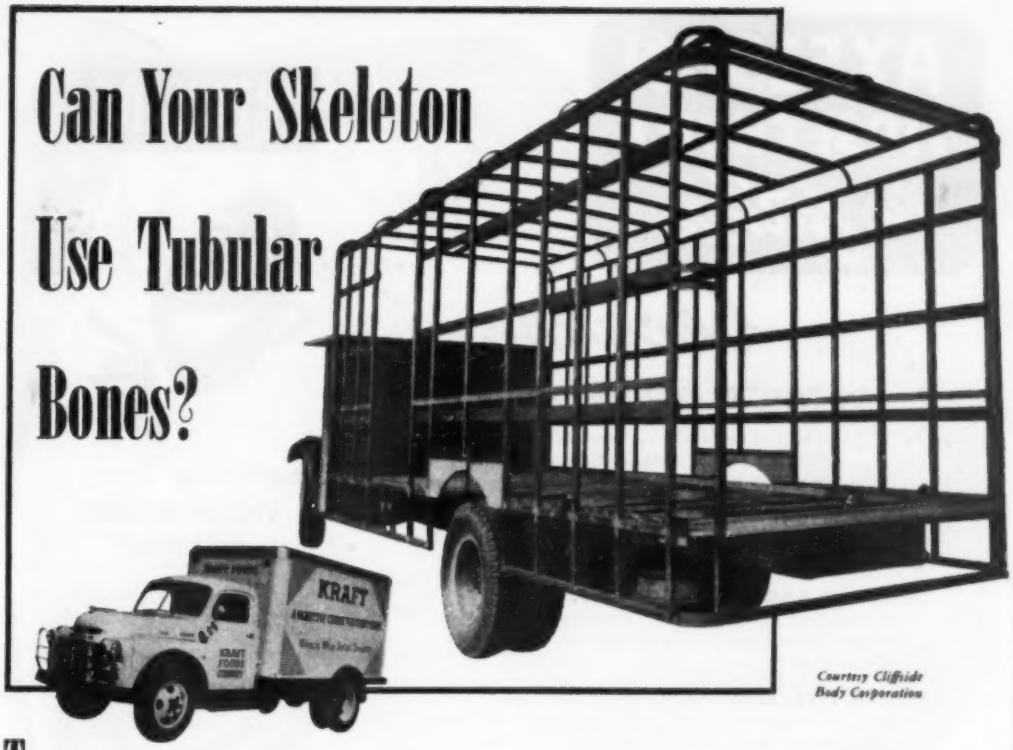
180 Vanderpool Street

Can Your Skeleton Use Tubular Bones?



Courtesy Cliffside Body Corporation

The "bones" in this skeleton are square steel tubes, welded together to make a stiff, rigid frame. The idea, used here to form a truck body, is easily adapted—you may find it profitable.

In this instance, the tubular construction, developed with the help of Frasse specialists, replaced a complicated system of bolted channels, gussets, cross fittings, angles and similar parts. Result? A stronger, more rigid, squeakless body—25% lighter, with more capacity for pay load . . . faster, neater assembly . . . greater flexibility of design . . . and 3 items to inventory instead of 60.

While mechanical tubing is widely used "to save machining the hole", it is equally handy for structural use. It pays—in product improvement, lower production cost, *often in material cost,* to think of tubing in your product.

And when you think of tubing, think of Frasse. Frasse stocks mechanical tubing, pressure, hydraulic and condenser tubing, stainless tubing—even stainless pipe and fittings. In addition, Frasse maintains a fully qualified engineering department that is always available to assist you in problems involving mechanical steels. Call us. *Peter A. Frasse and Co., Inc., 17 Grand Street, New York 13, N.Y. (Walker 5-2200) • 3911 Wissahickon Avenue, Philadelphia 29, Pa. (Baldwin 9-9900) • 50 Exchange Street, Buffalo 3, N. Y. (Washington 2000) • Jersey City • Syracuse • Hartford • Rochester • Baltimore*

Send for this FRASSE *Tubing Inventory*

This handy booklet lists each mechanical tube size immediately available from Frasse warehouse stocks—a useful reference and purchasing guide. Send the coupon for your copy today.

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is immediately apparent the first time a machinist puts the tool to the work. Velvet-smooth control action—continuous flow of power at the cutting tool without vibration or chatter.

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permits a wide variety of operations with all types of tools on any kind of stock.

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with precision accuracy from the beginning to the end of each cut. Massive construction throughout maintains absolute alignment.

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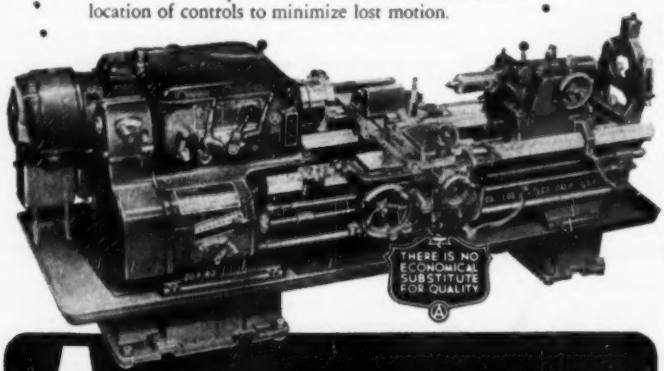
is assured because of faster speeds—greater ease of operation—ample reserve of smooth power at the cutting tool to handle any work without slow-down—scientific location of controls to minimize lost motion.



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Victor Hack Saw Blades are precision made from start to finish. Take toothing. Victor Blade Teeth are always perfectly uniform with no uneven teeth. That's because they're cut by a special machine using scores of *individually* ground toothing tools that are always accurately set. No other manufacturer cuts teeth this way.

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(For Forming Solid and Tubular Shapes)
PIERCING AND LAMINATION DIES

Runs of a Million or more

Improved shop practice reduces costs, helps meet competition. And you'll reduce costs with money-saving, time-saving Talide Dies that outwear steel dies at least 20 times, and on many occasions outwear them as high as 50 to 1. Too, down time of your equipment can be reduced by over 50% since Talide Metal needs little redressing. Made from hardest metal known, with great compressive strength, wear on Talide drawing dies after thousands of draws is almost negligible! Send for Die and Wear Part Catalog 48-WP.

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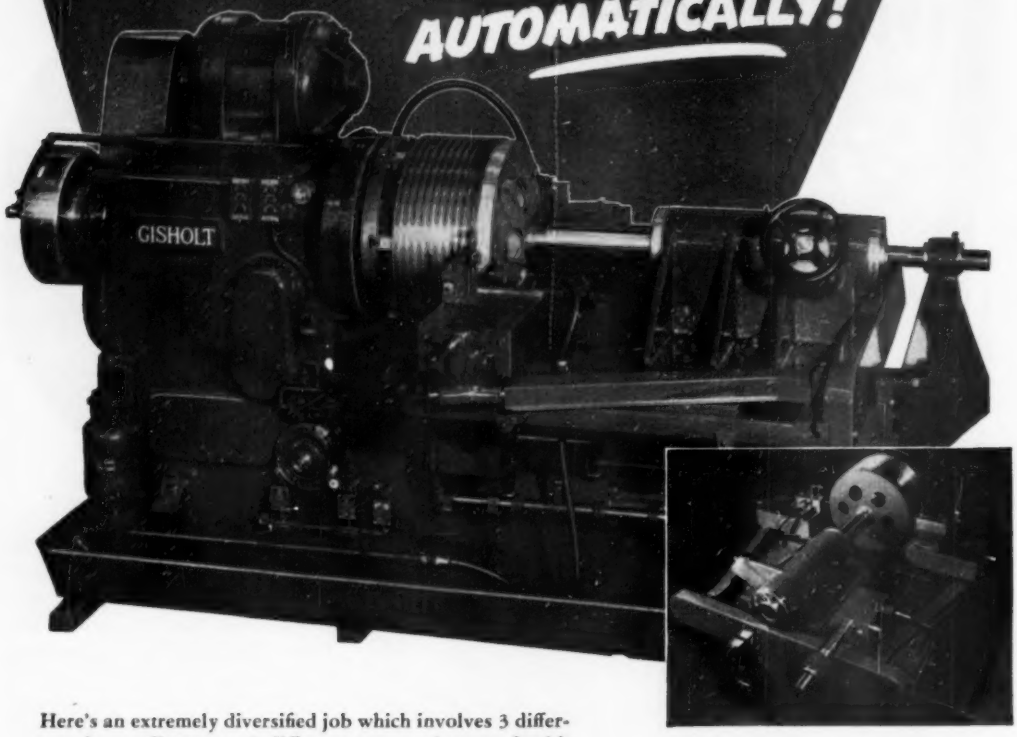
METAL CARBIDES CORPORATION

YOUNGSTOWN 5, OHIO *Pioneers in Tungsten Carbide Metallurgy*

CUTTING TOOLS · DRAWING DIES · WEAR RESISTANT PARTS

How the SIMPLIMATIC machines 212 different multiple V-belt sheaves AUTOMATICALLY!



Automatic pawl fitting into notched bar sets groove position. A single tool bit on the front slide roughs, while the tool bit on the rear slide finish forms. At end of cut, table is automatically repositioned for next groove. Spindle stops and table retracts automatically at end of job.

Here's an extremely diversified job which involves 3 different sheave diameters, 3 different groove sizes—and with from 3 to 10 grooves on each sheave . . . a total of 212 different combinations! Yet the entire job is simplified to *one* machine—the Gisholt SIMPLIMATIC. The SIMPLIMATIC handles them all automatically—with various pick-off gears and face clamps. The grooves are machined progressively one at a time to avoid excessive heat and strains in the workpiece. Total machining time ranges from 2.7 minutes for the smallest to 11.5 minutes for the largest.

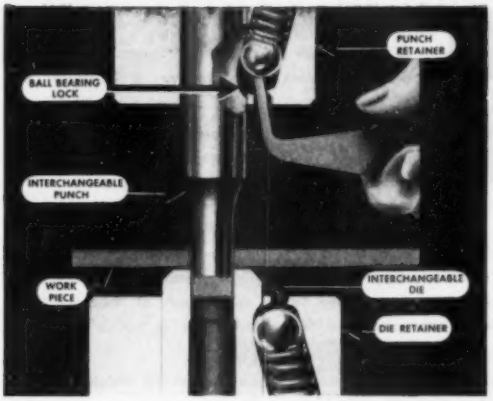
It's one more example of the amazing versatility of this automatic machine. Investigate the SIMPLIMATIC before you invest in a special machine.

THE GISHOLT ROUND TABLE
represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



This R-B Interchangeability Guarantees Piercing Economy*

You can count on low piercing costs when you use R-B interchangeable punches and dies. Their simple, trouble-free design and construction provide quick insertion—instant removal, reducing press "down-time" for replacements to a minimum. And, because they're standardized and interchangeable, R-B punches and dies also cut designing time and simplify die-building.

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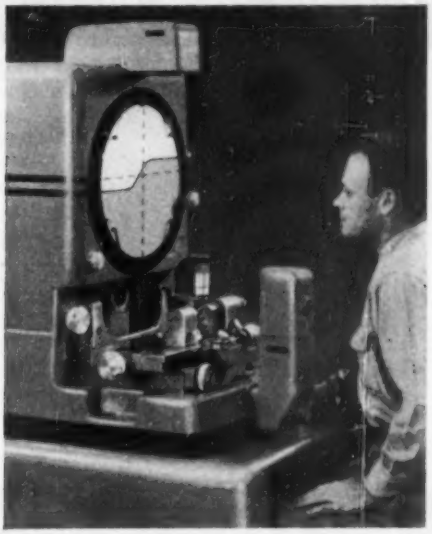
NOW THE MOST VERSATILE OPTICAL COMPARATOR YOU CAN BUY



Kodak Contour Projector Model 2

It handles large parts. There's 6¾ inches from lamphouse to object and 8 inches from object to lens—*at all magnifications.* Front lamphouse pivots to make room for long objects under surface illumination. Vertical travel is 4 inches.

It gives surface illumination in any of 5 planes, and switches instantly from surface illumination to silhouette projection, or to a combination of both. Instant dialing to any of 6 magnifications from 10× to 100× without distortion. The 14-inch screen is extra bright; no hoods or curtains needed —even in fully lighted rooms. Designed for all-day operator comfort, yet built to precise toolroom standards.

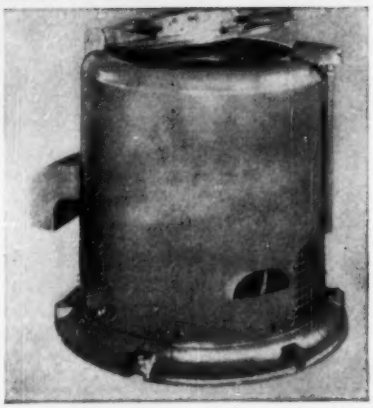
May we show you the savings it can make on your own inspection problems?

EASTMAN KODAK COMPANY
Industrial Optical Sales Division
Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR SHOWS { contours, of course / surface details... / deep, blind holes

Kodak

DRY SMALL PARTS QUICKLY and ECONOMICALLY with BARRETT CYCLONE CENTRIFUGAL DRYERS



The Barrett Centrifugal Dryer — efficient, self-contained, and compact is built in several sizes.

● The Barrett Parts Drying Process centers around a method of creating a guarded cyclone.

In operation, parts to be dried are placed in a well ventilated motor driven rotating basket. Free liquid is immediately thrown off by centrifugal force and any moisture remaining on parts is absorbed in the shortest possible time by the large volume of expanded air continually forced over and through the contents. Provision is made for heating and expanding, also boosting the flow of incoming air to assure faster absorption of moisture. With the large exhauster provided, heated air is not always required.

Direction of basket rotation can be quickly reversed which will change position of the load and accelerate drying. Baskets are available in shapes which experience has shown to be most effective for handling various classes of work.

It will pay to investigate the advantages offered by Barrett Centrifugal Dryers on your work.

Full Details of the Barrett Cyclone Dryer Sent Promptly on Request.

THE LEON J. BARRETT COMPANY, 1800 Grafton Road, **WORCESTER, MASS.**

Designers and Builders of Centrifugal Machinery

STAMPINGS IN SMALL LOTS

Precision Die Made—Lowest Possible Cost.

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DAVIS KEYSEATER

This low cost machine will handle internal keyseating jobs up to 1 in.

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Patented Cutting Off Tool Holders
Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits sufficient expansion of burdock chips MEANS MAXIMUM CUTTING EFFICIENCY

Manufactured By
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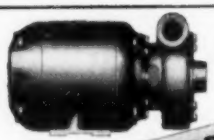

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HIGH EFFICIENCY • LOW POWER CONSUMPTION
GREATER VOLUME AND LESS MAINTENANCE

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High Speed Full Muffle Furnaces designed for High Carbon and Alloy Steels. Also Semi-Muffle Furnaces for Low Carbon Steels, Preheating and Other Uses. Send for Catalog of Gas Furnaces, Burners, and other equipment.

CHARLES A. HONES, INC.

121 So. Grand Ave. Baldwin, L. I., N. Y.

A rugged "STELLITE" TOOL produced this CHIP

ACTUAL SIZE

FROM A ROUGH CASTING THAT AVERAGED 250-330 BRINELL

This extraordinary chip was produced by a HAYNES STELLITE tool. It was formed during a machining operation that in less than 5½ hours removed half a ton of metal from the gate end of a rough casting. The casting was of air-hardening ordnance steel and had a Brinell hardness between 250 and 330. While this is an unusual example, it gives a good idea of how efficiently HAYNES STELLITE cobalt-base alloy tools can cut metal.

The metal removal rate was fast. The feed varied from 0.040 to 0.060 in. per revolution during roughing. Depth of cut was sometimes greater than an inch. To take a bite like that, a tool needs both toughness and red hardness. Some of the tools used on this job removed as much as 280 lb. of metal per grind.

The shiny underside of the chip gives a good idea of the finish that can be produced with HAYNES STELLITE tools, even though this operation was rough turning. Because they are tough, HAYNES STELLITE tools can be designed with comparatively large cutting-edge angles and nose radii. They do not need a large lip thickness to withstand impact. This, too, increases the ability of a tool to impart a fine finish to a workpiece.

If you would like to know more about how HAYNES STELLITE tools can be used to speed up machining operations, write or phone our nearest District Office. Our engineers have, at their disposal, the experience of 35 years in the high-speed machining of steel, iron, and non-ferrous materials. They will be glad to help you.

HAYNES alloys
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Houdaille Conveyor

Write for Case Histories on these typical **HOUDAILLE** Conveyor installations!

WILL CUT COST . . . SPEED UP PRODUCTION IN YOUR METAL WORKING OPERATIONS

Houdaille Conveyor's automatic loading and continuous materials transport will handle any solid or fibrous material (chips, abrasive sludge, scale, etc.) which will settle to the bottom of a tank or hopper. Many metal working plants have saved substantially on production costs . . . labor, maintenance, down-time, etc. . . . by installing one or more Houdaille Conveyor systems. Look at these important Houdaille advantages:

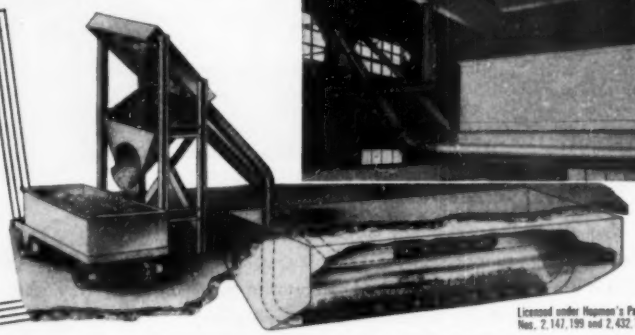
● Eliminates costly manual handling methods. ● Operates continuously or intermittently as needed without shutting down productive machinery ● Readily adaptable to almost any space or traverse requirement ● Dependable, trouble-free operation . . . requires little or no maintenance attention . . . quickly pays for itself out of savings.

ABOVE: Houdaille Conveyor for continuous metal chip removal at large motor car plant paid for itself in one year.

BELOW: Houdaille Conveyor for removal of sludge in dust collecting system, Minneapolis Electric Steel Castings Company, saves $1,092 annually.

Ideal for Removal of:

- Cast Iron Dust and Chips
- Aluminum Dust and Chips
- Abrasive Sludge
- Scale resulting from quenching, metal cleaning, steel rolling, brass rolling, aluminum rolling, wire drawing
- Material from Dust Collectors
- Plastic Powders
- Many Others



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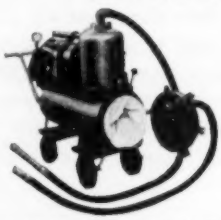
Save Time...Save Money with HOUDAILLE "One-Man" Units for Oil and Coolant Filtration and Handling

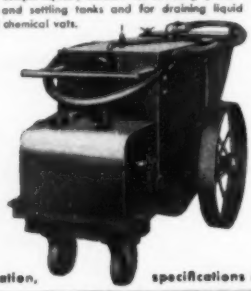


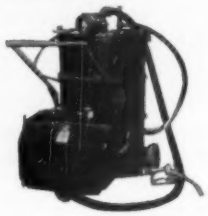
Houdaille Mobile Coolant Filter

This mobile one-man unit can serve any number of machine tools . . . will clean up an individual machine sump in less than ten minutes. Coolant is drawn through a close-woven cloth bag which removes solid particles such as dirt, chips and abrasives. Clean coolant is returned to the sump.

Houdaille Sump Cleaner

A time saving, one-man unit for removal of cutting oils or coolants contaminated with abrasive, grindings, chips and other solids from machine tool sumps. Equally suitable for cleaning quenching and settling tanks and for draining liquid and chemical vats.





Houdaille Oil Dispensing Unit

This handy truck is designed primarily to dispense oil from drums to machine tool reservoirs or sumps. May also be used to transfer oil between drums or to remove oils or coolants from tanks for dispensing to machine tool sumps. One man can easily operate the unit and do a fast, clean oil handling job at considerable saving in time and labor.

Write for complete information, specifications and operating details.

HONAN-CRANE CORPORATION 223 SUPERIOR AVENUE, LEBANON, INDIANA

A Subsidiary of **HOUDAILLE-HERSHEY CORP.**

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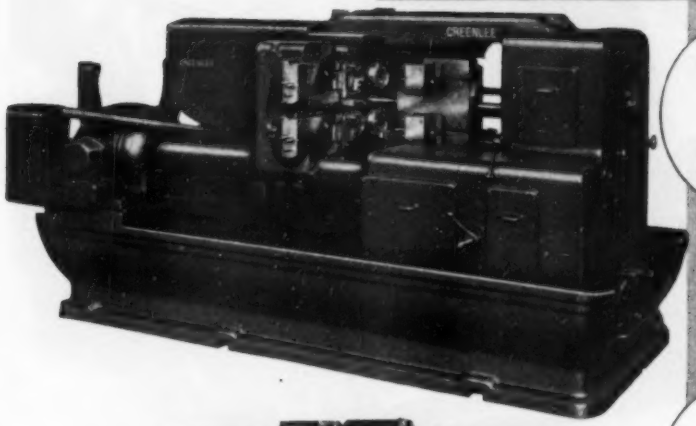
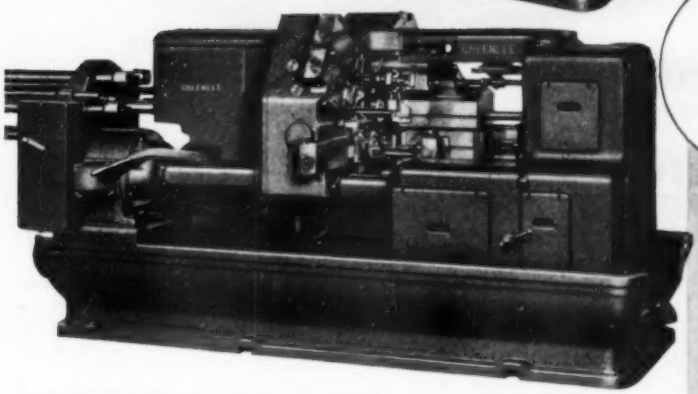
AUTOMATIC SCREW MACHINES



4 SPINDLE

HEAVY DUTY "FOUR"

Made in 1⅝" and 2⅛" spindle capacities for all types of heavier work suitable to four-position machining. Includes all cost-cutting features of the versatile "Six".



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WIDE RANGE "SIX"

Made in 1", 1⅜", and 2" spindle capacities to cover the majority of work normally assigned to screw machines. Handles a wide variety of set-ups efficiently and economically.

VERSATILE, EFFICIENT, ECONOMICAL

Greenlee Automatics have made a name for themselves in forward-looking production shops . . . not only for their exceptional versatility, but also for their cost-cutting efficiency particularly on change-overs, and for other economies possible to achieve with them. Adaptations of standard models are available . . . for second-operation work . . . for tooling extra-long work pieces . . . for multiple feed-out . . . for air feed to eliminate pusher marks, etc. Send us prints or sample pieces. *Let our engineers show you how profitably Greenlees can be applied to your production.*

PRODUCTION MACHINERY
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Write for our **FREE** monthly publication, **AUTOMATIC NEWS.** Please use your company's letterhead.

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OUTSTANDING FEATURES

UNIVERSAL TOOLING — Tool holders fit any cross-slide cavity . . . are easily and quickly changed . . . reduce equipment costs.

INTERCHANGEABLE CAMS — Can be changed at will without re-adjustment of tools and holders. Cam storage is held to a minimum . . . cam costs greatly reduced.

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LARGE TOOLING AREA — Permits using many timesaving, cost-cutting auxiliaries that often eliminate second operations.

MULTIPLE SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

was this call necessary?

Some "Moral Insurance" here might have avoided a serious accident

Workmen's compensation is a fine thing—but it can't replace a mangled arm.

Safety laws prevent many accidents—but they can't cover every hazard of an individual plant.

Accident prevention which goes *beyond the law* is an unwritten responsibility of every employer. It is his "Moral Insurance" for his employees welfare.

The premiums for "Moral Insurance" are not high. They do not have to be paid for in fancy safety gadgets. Their cost is simply the institution of common sense safety regulations covering all local hazards—enforced by employee committees with the full support of management.

Yes—"plant safety" is a mutual job.

DON'T FORGET—THE LIFE YOU SAVE MAY BE YOUR OWN

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MODEL D-1 DIAL TYPE

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Famous for

- ACCURACY OF THREADS
- LOW CHASER COST
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Bulletins available. General Purpose Die Heads. Insert Chaser Die Head. Threading Machines.

H&G DIE HEAD

See our Advt. on Page 39, Feb. 16'50 American Machinist

THE EASTERN MACHINE SCREW CORP., 30-40 Barclay St., New Haven, Conn.
Pacific Coast Representatives: *A. C. Behringer, 884 N. San Pedro St., Los Angeles, California. Canada: F. F. Barber Machinery Co., Toronto, Canada.*

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Special Machinery

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90¢ per line, minimum 4 lines. To figure advance payment count 5 average words as a line.
POSITIONS WANTED (full or part-time individual salaried employment only). ½ above rates.
PROPOSALS, $2 cents a line an insertion.

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BOX NUMBERS count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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The advertising rate is $9.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅛ inch vertically on one column, 3 columns—30 inches to a page. A.M.

NEW ADVERTISING received by 10 A.M. Nov. 28th will appear in the issue of Dec. 11th subject to limitation of space available

MACHINERY DESIGN ENGINEER for

Permanent employment with a leading Connecticut manufacturer of machine tools. Must have extensive experience in the design and engineering of Lathes, Grinders, and/or, Milling Machines.

Send complete resume of qualifications and experience. Interviews for qualified applicants will be arranged promptly. All replies will be kept confidential.

P-8100, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED MACHINE DESIGNERS

A large middle west machine tool builder requires the services of several capable machine tool designers with a technical and practical background. Splendid opportunities available for qualified persons. Give complete details of self, education, experience and salary expected.

P-7854, AMERICAN MACHINIST
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MAJOR INDUSTRIAL CONCERN Has An Opening For MACHINE SHOP GENERAL FOREMAN

Machinist background, with at least 12 years experience, capable of setting up shop and establishing new procedures. Applicant should have five years supervisory experience and a satisfactory record handling men. Considerable formal schooling desirable but not necessary.

Reasonable rental housing available. Moving expenses paid.

Submit complete summary of experience and education to

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SENIOR ENGINEER WANTED

By consulting engineering firm located in New York City. Must be graduate of recognized engineering college with manufacturing experience in metal working industry as Plant Manager or Assistant Plant Manager. Age 35-45. Give age, education, experience, references and salary required. All replies kept confidential.

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ENGINEER

with experience in Development and Design of Centrifugal Pumps for manufacturing plant in New England. State qualifications and references.

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For experienced senior and junior engineers

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Cinn. 12x48", & 12x36" Filmatic Univ.
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Gardner #2226, 30" Disc.
Hanchett #2218 Disc. Dbl. opposed w. M.D. Feed.
Heald 72A8 Sizematic Int. Centerless
K.O. Lee Tool & Cutter.
Landis, 10x24" Type C Univ., 10x36" angular, 10x36" Univ.
Norton No. 2 Tool & Cutter, Hyd.
Oliver 510 Drill Grinder, Sellers 6G, 4G Drill Grinder
Wickman Profile

GRINDERS, SURFACE
Abrasive No. 33, 34 Vert. 8x24.
Blanchard No. 11, 16" Mag. Chuck.
Brown & Sharpe #25, 8x24"
G & L Hyd. #25, 6x18", #45, 12x24".
Heald No. 22 Rotary 14" chuck
Norton 6x18", and 10x36" Hyd.
Reid No. 2A P.F. M1B.
Reid No. 2C Motor Spdl. Hand Feed.
Thompson Hyd. 6 x 10 x 18", 6 x 12 x 18"

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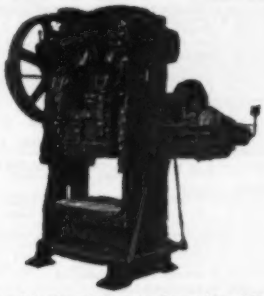

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Watson Stillman Shaft Straightener	500	24"	57"	24" bed.
Denison	25/50	18"	23"	22 x 20
Hamilton	50	20"	36"	22 x 36
Southwark, D. A. Clamping Plate	125	30"	2' to 4'	84 x 30
Oilgear Shaft Straightener	35	8"	12"	84 x 11

DOWN MOVING RAM, WITHOUT POWER UNIT

Mesta	750	42"	85"	44 x 44
Chambersburg	300	10"	27"	22 x 36
Southwark	350	42"	78"	28 x 48
Southwark	550	23"	48½"	42 x 32

UP MOVING RAM PRESSES

Waterbury Farrel	800	6½"	28"	22 x 24
Watson Stillman	300	12"	21"	24 x 20
Watson Stillman	300	12"	19"	20 x 20
HPM	180	15"	14½"	30 x 30
Stokes Molding Press & Pump	50	7"	25"	20 x 12
Elmes—With Elec. Plates	50	6"	12"	18 x 18
Stewart Soling	85	10"	19"	20 x 20

WHEEL PRESSES
NILES — 400 ton 96" 500 ton — 48"; 300 ton — 48.

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Mfr.	Size	Pounds
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General Electric	13" x 11'	400
Watson Stillman (13 gal) Hydr. Fees.	42 x 9 x 48"	3000

Lodge & Shipley 14 x 72" T.A., Collets, etc., 20"x54" 24 speed G.H.
Monarch 10"x20" EE.
Rivett 608 QCG, TA, Precision
South Bend Q.C.G., 18"x8', 16"x4'

MILLS, PRODUCTION
Brown & Sharpe, No. 00S, 1S, 2S
Cincinnati No. 2-18 Mfg., 50-06 hydromatic
Kent Owens IV
U. S. Multimiller, 1 & 2 Spindles.
Sundstrand 60 Rigidmills

MILLS, PLAIN AND UNIVERSAL
Cincinnati #3 Plain Hi-Speed Dial Type
Cincinnati No. 3 Plain, 2M Plain
Cincinnati No. 4 Univ.
Milwaukee 2HL, 2H Univ., H.S.
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Van Norman Duplex, 20.

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Gorton No. 2½ D Profiler
Morey No. 12M Profiler 2 sp.
Sipp MP6 Jig Borer
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Pratt & Whitney #2 Jig Borer
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Bliss No. 4¼ Double Action Cam
Colton Tablet Presses.
Gen. Flexible Screw Press.
Stokes Tablet Presses, Model R & T, DD2.
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Bardons & Oliver No. 3, 1⅛" cap., No. 5, Chuck.
Brown & Sharpe 2F
Foster No. 3B.
Gisholt No. 4, Bar and Chuck, 2L, Saddle Type Cross Sliding Turret
Warner & Swasey 4A 6" Cap. Power chuck

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Centering Machine: Sundstrand.
Die Casting Machine DCMT
Hacksaw: Marvel Nos. 6 and 6A, 9A Automatic Feed.
Marking Machine: Noble & Westbrook
Notching Press: Ferracute C61.
Pin Machine: Nilson.
Profilers: Cinn. 3S8" 4 Sp., Morey 12M
Shaper: Cinn. 24" Universal.
Sheldon 12" Brand New.
Rotary Shear: Quickwork 3/16" Cap, 36" throat circle cutting attach.
Honer: Micromatic Hydrohoner, Sunnen.
Keyseaters: Mitts & Merrill, Baker, Burr, Davis.
Lappers: Ultralap.
Rivet Hammers: Hi Speed.
Toolmakers Microscope: Gaertner, Bausch & Lomb, Leitz
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NEWARK #5, 72" Hobber with Infeed and Diff. M.D.
PRATT & WHITNEY 16" Grinder, hyd., latest

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BROWN & SHARPE #5 Plain, 3 x 13, Latest Type
CINCINNATI 16"x36" Model E.R., Univ., Latest Type
LANDIS 4x12, Type H, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., Latest Type
LANDIS 16"x18" type C Univ.—latest type
LANDIS 29"x130" Plain Roll, Motor Drive
NORTON 16"x72" Type C, Plain, Latest Type
NORTON 17"x72" Centers Crankpin Grinder, Hyd., Latest type

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BROWN & SHARPE No. 13 Univ. Cutter & Tool Lat.
BRYANT #3, #6, 16-C-16, 16-CP-16, 24-36" Internal, Hydraulic, Latest Type
FITCHBURG 14"x25" Spline hydraulic, latest
HEALD 72A5, Hydraulic, Internal, latest type
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La POINTE 60" Universal Broach Sharpener, Latest
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BLANCHARD 16A Vertical, Dial Feed, Motor Drive
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LIBBY "International" 1H5 Univ., Timken, Latest
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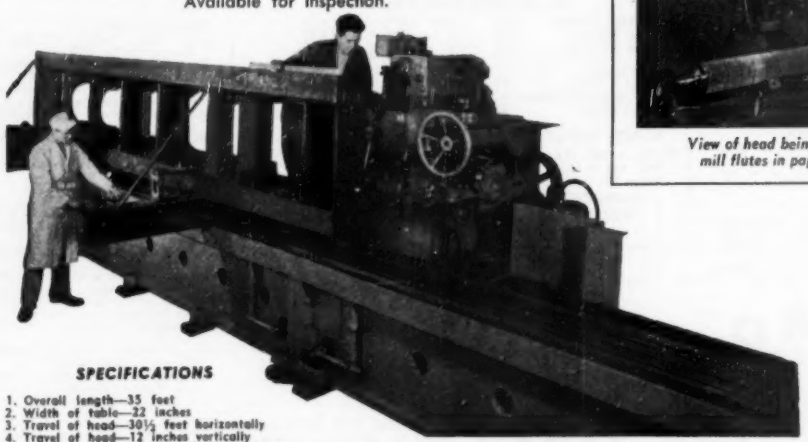

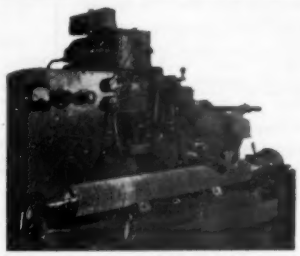

View of head being used to mill flutes in paper roll.

SPECIFICATIONS

1. Overall length—35 feet
2. Width of table—22 inches
3. Travel of head—30½ feet horizontally
4. Travel of head—12 inches vertically
5. Quill movement—6 inches—horizontal quill
6. Spindle speeds—350 to 1217 RPM—rheostat adjustment
7. Head travel 5" to 40" per min.—200" per min. rapid traverse
8. Power—250 Volt D.C. Spindle motor is 15 H.P. Feed Motor is 3 HP. Machine is equipped complete with all electric motors, contractors and controls.
9. Machine is equipped with a hydraulic cam follower device for contour milling.
10. Machine is equipped with leveling jacks.
11. Weight—52,000# (approx.)

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SGLE. SPDLE. DRILL, Buffalo #2MS. 26" #3 M.T.

SGLE. SPDLE. DRILL, Aurora 36" Bgrd. #5 M.T.

SGLE. SPDLE. DRILL, Colburn #2 Mfg. #4 M.T. 20".

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TWO SPDLE. DRILL, Leland Gifford #2LMS 20". #2 M.T. 11" c.c.

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RADIAL DRILL, Mueller 3½' Arm, 11" Col. #4 M.T.

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RADIAL DRILL, Cinci-Bickford 6' Arm, 15" Col. #5 M.T.

3—SPDLE. DRILL, Leland Gifford #2 MS—14". 11" c.c.

3—SPDLE. DRILL, Edlund #2D. #2 M.T. 10". 9½" c.c.

4—SPDLE. DRILL, Leland Gifford 20". #2 M.T. 11" c.c.

4—SPDLE. DRILL, Demco #KT. #2 M.T. 24". 18⅝" c.c.

5—SPDLE. DRILL, Leland Gifford 14". #2 M.T. 10" c.c.

DRILL, Avey-Matic #3 Hvy. 2-Spdl. #3 M.T. 24". 15" C.C.

DRILL, Cincinnati 21" Bgrd. Drilling & Tapping.

DRILL, Radial, Cinci-Bick. 5' Arm, 13" Col. #5 M.T. 24 speed gearbox. 7½ h.p. 3/60/220.

DRILL, L. Gifford #2MS 14". 11" C.C. 3-Spdle

DRILL, Baker #314 Hvy. Pattern High Speed Vertical Boring & Drilling Machine, 7½ h.p. 220/440 motor, #5 taper, 12 feeds, 6 speeds, 12¼" throat. 3" Capacity in steel.

DRILL, Leland Gifford #2LMS Upright Sliding Head Two Spindle, #2 taper, 13" overhang. Independent 220 volts, 4-speed motors, indicated spindle speeds.

PARTIAL LISTING OF LARGEST STOCK IN THIS AREA

DRILL, Natco #12 Multiple Spindle Motor Driven, #1 taper, 5 h.p. 220/440 motor. Arranged for 16 spindles, Rectangular head, With Natco 24" Rotary Table.

RADIAL DRILL, Carlton 4'-13". Motor Dr.

STRAIGHT BEVEL GEAR GENERATOR 3" Gleason, Serial #18064, NEW — 1942, 220/440 volts motors. Gear Cabinet, Full Set of index gears. Dog-mouth, Auto-feeds Attachment, Pneumatic Chuck Equipment, Cutter Setting Gauges & segment Setting Gauges, Duplete Cutting Cam & Duplete Feed Cam.

BASE PITCH & SPACE MEASURING MACHINE, Gear Illinois, Late Type—Like New. Capacity—14" Diameter gear, 10" Between centers. Full set of Master and straight Contact Fingers, Dial Indicator, Tailstocks and Leatherette Cover.

SURFACE GRINDER, Horiz. #15 Covel 19½"x17½".

SURFACE GRINDER, Horiz. Leach 6"x12" Hand. NEW

SURFACE GRINDER, Horiz. Thompson 18"x6" Hydraulic.

GRINDER, Cylindrical, Norton 10"x24" Hydraulic.

GRINDER, Cylindrical, Norton 6"x30" Hydraulic.

GRINDER, Cylindrical, B & Sharpe #4 Univ. 12x60.

GRINDER, Cylindrical, B & Sharpe #10. 6x18.

GRINDER, Cylindrical, B & Sharpe #5. 3x12. Late.

GRINDER, Cylindrical, Cinci. 6x18 Hydraulic.

GRINDER, Cylindrical, Norton 6x18 Hydraulic.

THREAD GRINDER, J & Lamson #TG-615 Automatic, Late type

GRINDER, Blanchard #16, 20" Chuck Vert Rotary.

GRINDER, Landis Crank 10x32 Hydraulic.

GRINDER, Brown & Sharpe #2 Auto. Horiz. Surface.

GRINDER, Cincinnati #EA, 10" x 30" Hydraulic Cylindrical. Pilimatic Bearings, 220 volts motors. Built-in electrics, Hydraulic infeed.

GRINDER, Norton 6 x 18 Hydraulic Vert. Rotary Auto. Lasalle Spdle.

GRINDER, Norton 6 x 18 Hydraulic Horiz. Surface. Lasalle Spdl.

GRINDER, Pratt Whitney 22" Vert. Rotary. 84" Table Travel.

GRINDER, Bath 10"x25" Motor Driven Universal Surface, 220/440 volts motor with two-speed pedestal control, Internal Grinder Attachment & Steady Rest, etc.

KEYSEATER, Mitts & Merrill #3 Grant Motor Driven, 440/440 volts motor, Capacity—one inch, 3" wide keyway, Automatic Feed.

LATHE, 16"x6' American Q.C.G. Grd. Hd. 8 speeds.

LATHE, 32"x10' Bridgeford Q.C.G. Grd. Hd.

LATHE, 20"x10' Bridgeford Q.C.G. Grd. Hd.

LATHE, 24"x8' Lodge Shipley, Hvy. Duty.

LATHE, 24"x14' LeBlond Q.C.G. Grd. Hd.

LATHE, 20"x10' American Q.C.G. 72" c.c.

LATHE, 20"x10' Hendey Q.C.G. Taper Att.

LATHE, 20"x6' Lodge & Shipley Q.C.G.

LATHE, 18"x6' Lodge Shipley Q.C.G. Grd. Hd.

LATHE, 16"x6' LeBlond Q.C.G. Taper Attach.

LATHE, 16"x6' Lodge Shipley Q.C.G. Grd. Hd.

LATHE, 14"x6' Hendey Q.C.G. Taper Attach.

LATHE, 14"x6' Hendey Q.C.G. Taper Attach.

LATHE, 12"x5' Hendey Q.C.G. Taper Attach.

LATHE, 10"x24' Logan #320 Q.C.G. NEW

LATHES, Turret, #1 Bardons & Oliver. ¾".

LATHES, Turret, #001 Oster Grd. Hd. 1¼".

LATHES, Turret, #2B Simmons Grd. Hd. 1¼".

LATHES, Turret, #2G Morey Grd. Hd. 1".

LATHES, Turret, #4 W & S Univ. 1½".

LATHES, Turret, #3A W & S Univ. 3½".

LATHES, Turret, #3 J & L Univ. 1½".

LATHES, Turret, #2 Simmons Grd. Hd. 1".

LATHE, American 27" x 10' Grd. Hd. 12 speed. Taper Attach. & Chuck.

LATHE, LeBlond 26" x 30', 220/440 motor, 12 speed head, taper attachment, steady rests, etc.

LATHE, Bridgeford 26"x14' Q.C.G. 9'3" C.C. 220 volts two speed motor.

LATHE, Hardinge #30 High Speed Second Operation Machine, 1" Collet Cap. Automatic Collet Mechanism, collets, collet chucks, etc. FOUR.

LATHE, Monarch 18"x48" Model #CBB.

TURRET Lathe—Gisholt #4 Univ. Grd. Hd.

TURRET LATHE, Bardons & Oliver #7 Universal Grd Hd. Ram Type. Hydraulic Speed Selector, 2½" Cap. 10 h.p. 220/440 motor, With Chuck, toolholders, etc.

MILLING MACHINE, Vert. #3 Cinci. High Power.

MILLING Machines, Vert. #4 Cinci. High Power.

MILLING Machine, Horiz. #2, #3, #4, #5 High Power.

MILLING Machine, Horiz. #2SP Van Norman.

MILLING Machine, Horiz. &2M Cincin. Univer.

MILLING Machine, Horiz. #3 Kempsmith Univer.

MILLING Machine, Horiz. #4 LeBlond Univ. Hvy.

MILLING Machine, Horiz. #1½ B & Sharpe Univ.

MILLING Machine, Horiz. #2 Kempsmith Univ.

MILLING Machine, Horiz. #2 B & Sharpe Univ.

MILLING Machine, Horiz. #3 B & Sharpe Univ.

MILLING Machine, Duplex. Cochrane-Bly #14 Univ. Mill & Shaper. #8 Taper, Shaper—9" to 6" Stroke. Rotary Table. 220-440 volts.

MILLING Machine, Duplex, Cincin. 24" Automatic.

MILLING Machine, Duplex, Van Norman #2.

MILLING Machine, Cincin. #4—30 Plain Hydmatic.

MILLING Machine, Cincin. #4—30 Duplex Hydmatic.

MILLING Machine, Prod. #1—18 Cinci. Hor. Auto.

MILLING Machine, Prod. #0—6 Cinci. Vertical.

MILLING Machine, Prod. #0—6 Cinci. Auto. Horiz.

MILLING Machine, Production, #12 B&S 18" Late Type (6).

MILLING Machine, Prod. #12 B&S 24" Late Type.

MILLING Machine, Horiz. K&T #2B Dble. Overarm. 220/440.

MILLING Machine, Horiz. K&T #3B Dble. Overarm. 220/440.

MILLING Machine, Horiz. Atlas Semh Mill, Like New

MILLING Machine, Horiz. Nichols Hand Millers, late type.

MILLING MACHINE, Cincinnati Vertical #3 H.S. Dial Type. W/Rotary Table.

MILLING MACHINE, U. S. #MMI-0 Cam Controlled Automatic Horizontal, #40 taper, Late Type, 220/440 motors, TWO.

O.B.I. PRESS, Bliss #21B. 40 tons. 2½" Stroke.

O.B.I. PRESS, Bliss-Cox. #3½p. 62 tons. 4" Stroke.

POWER PRESS, Bliss #164 Open Back S.S.S.A. 65 tons, 4" Stroke.

POWER PRESS, Bliss #84, S.S.S.A. 36 tons, 10" Stroke, 39" between uprights.

POWER PRESS, Bliss #78½, S.S.S.A. 120 tons, 5½" Stroke. 24" between uprights.

POWER PRESS, Bliss #3A S.S. Dble. Crank S.A. Grd. 45 tons, 4" stroke, 36" between uprights.

WHEEL PRESS, Niles B & Pond 200 Tons Hydraulic Horizontal, 48" between struts bars. Two Plunger Type, 7.5 h.p. 220/440 motor.

POWER PRESS, Bliss-Consolidated #77 Open Back Gap Frame Sgle. Crank Sgle. Action Back geared. 175 tons, 10" stroke, Bed area—24" x 42", With Roll Feed and Roll Straightener.

POWER PRESS Farnsworth #50 Double Crank Sgle. Action, S.S. Geared, 85 tons, 1¾" stroke, Bed area —61½" x 27½".

POWER PRESS — Bliss - Consolidated #160 - B Straight Side Dble. Crank Single Action, 45 tons, 9" stroke, Bed area—36" x 41", 15 h.p. 220 motor.

SHAPER, Vert., Pratt Whitney #8—6" Motor Dr.

SHAPER—Columbia 32" B.G. Crank.

SHAPER—American 24" B.G. Crank.

SHEAR, Gap Squaring Niagara #91258, 10'x¾". Overdrives. 10" Gap. 20 h.p. motor, 220 V. spring hold-down and extra blades.

SHEAR, Morgan 120"x½" Guillotine Plate, 30" Gap.

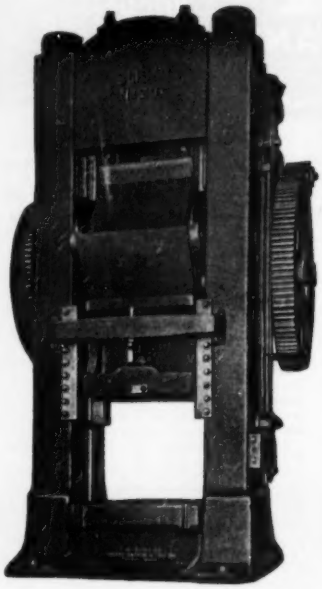
SHEAR, Quickwork #A-1 Rotary 60" Throat, 10 ga.

WELDER, Federal #712 AT Motor Driven Toggle Action Projection. New in 1936. 200 KVA, 19" throat. Stroke—1" to 3". With controls.

WELDER, Federal #624B Hvy. Duty Gap Type 75 KVA. 1½" Stroke. 17" throat. Motor driven. With controls.

EMERMAN OFFERS FROM STOCK

Late Type



TOLEDO KNUCKLE JOINTED COINING PRESSES---667---668

CAPACITY . . .	1200 TONS	1500 TONS
STROKE	5 "	6 "
DIE SPACE . . .	33½ "	36½ "

DOUBLE BACK GEARED

Pneumatic Operated Friction Clutch
Equipped with Two Station Air Operated Dial Feed
— Bottom Lift Out — And Air Operated Pickoff

***Also:* #6 National Maxi Forging Press 2000 ton cap.**
665 Toledo Coining.
78 Toledo Permanently inclined (2).
#2719—800 Ton Hamilton Press.
#57 Toledo Straight Side.
Trimming Press.

EMERMAN MACHINERY CORP.

870 W. 120TH STREET — *CHICAGO 43, ILLINOIS*

LATE TYPE MACHINE TOOLS

MAJORITY NEW SINCE 1940-1945

Fully Guaranteed

GRINDERS

6"x18" Cincinnati Plain Hydraulic
6"x18" Cincinnati Plain Hydraulic
10"x18" Norton Model C Plain Hydraulic. 1942
14"x48" Cincinnati Plain—1942
8" No. 20 Heald Rotary Surface
12" Arter Model A3 Rotary Surface
No. 25A Heald Hyd. Rotary Surface 27" chuck
No. 300 Hanchett Hyd. Vertical Surface
14" Pratt & Whitney Hydraulic Surface

PLAIN MILLING MACHINES

No. 08 Cincinnati—1941
No. 5 Cincinnati High Power—1942

VERTICAL MILLING MACHINES

No. 2 Cincinnati Dial type Medium Speed —1942
No. 3 Van Norman—1943
No. 08 Cincinnati—1941

NUT AND BOLT EQUIPMENT

¼" National Precision Nut Tapper
No. 2 Waterbury Farrell Nut Tapper
¼" Waterbury Farrell SSSD Header
No. 1½ Waterbury Farrell Nut Press

TURRET LATHES

No. 4 Warner & Swasey Universal Geared Head—1944
No. 3A Warner & Swasey Universal Geared Head
No. H-5 Libbey Geared Head—1941
No. 1FU Foster Fastermatic—1943

PRODUCTION MILLING MACHINES

No. 1 Sundstrand Rigidmil
No. 3 Sundstrand Rigidmil
No. 34-36 Cincinnati Hydromatic Plain—tracer cont. 1941
No. 58-96 Cincinnati Hydromatic Plain—1940

PLANERS

48"x48"x16' Cincinnati Hypro Double Housing. 1941
48"x48"x26' Niles Bement Pond
120"x96"x20' Cincinnati

LATHES

No. 10 Sundstrand Automatic Lathe
14"x30" Hendey. Geared Head. 1942
16"x30" Reed Prentice Geared Head—1943
42"x108" Niles Heavy Duty Geared Head. 1943
No. 3 Hendey Hi-Speed Turning Lathe

MISCELLANEOUS

No. 3 LeBlond Rifling Machine—1941
W. F. & John Barnes Horiz. Honing Machine—1942
No. 420 W. F. & John Barnes 2 Spdl. Deep Hole Driller & Borer. 1942
No. 12 Bertsch Seven Roll Plate Straightening Roll—1942
1⅞"Conomatic Eight Spindle Auto. Screw Machine—1941

J. L. LUCAS & SON, INC.

P.O. BOX #3006A — **BRIDGEPORT 5, CONN.**

Eastern Rebuilt Machine Tools

THE SIGN OF QUALITY — THE MARK OF DEPENDABILITY

PLAIN MILLING MACHINES

No. 000 Brown & Sharpe, m.d., latest
No. 1A Milwaukee, m.d.
No. 1M Cincinnati, m.d.
No. 1 Special Plain Kearney & Trecker Milwaukee, m.d.
No. 1½, 2, 3 Cincinnati, cone
No. 2B Brown & Sharpe, m.d., latest
No. 2 Cincinnati H.S. Dial, m.d., latest
No. 2 Cincinnati Plain H.P., belted m.d.
No. 2 Rockford, m.d.
No. 2G LeBlond, belted, m.d.
No. 2H Milwaukee, m.d.
No. 2M Cincinnati, m.d. in base
No. 3 Cincinnati H.P., m.d., p.r.t., late type
No. 3B Brown & Sharpe, m.d., late
No. 3, 4 Kempsmith Maxi-Miller, m.d.
No. 3B Milwaukee, m.d.
No. 3 Van Norman Duplex, s.p.d.
No. 4 Cincinnati H.P., m.d.
No. 4 Ohio, cone
No. 4K Milwaukee, m.d., late type
No. 5 Cincinnati, rect. overarm, m.d.
No. 5 H.D. LeBlond, s.p.d.
No. 5B Brown & Sharpe Heavy, m.d.

UNIVERSAL MILLING MACHINES

No. 2A Brown & Sharpe, s.p.d.
No. 2 Cincinnati, cone, motorized
No. 3 Kempsmith, cone
No. 3A Brown & Sharpe, s.p.d.
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati H.P., m.d.
No. 4G LeBlond, s.p.d.

VERTICAL MILLING MACHINES

No. 0B Cincinnati, m.d., latest
No. 2M Cincinnati, m.d.
No. 3, 4, Cincinnati H.P., m.d.
No. 2, 3, Cincinnati High Speed Dial, m.d., latest
No. 2, 3 Cincinnati Medium Speed Dial, m.d., latest
No. 4H Milwaukee, m.d., latest
No. 2HL Milwaukee Swiveling Head, m.d., latest
No. 2K, 3K Milwaukee Dial, m.d., latest
No. 2½B, 3B Milwaukee, m.d.
No. 3V Toledo, s.p.d.
No. 3V Van Norman, m.d., latest
No. 3 VG Reed-Prentice, m.d.
No. 5 Brown & Sharpe, cone
No. 6 Becker, cone
Cincinnati Hydromatic, m.d., 2 spindles

MILLING MACHINE ATTACHMENTS

16" Cincinnati Circular Milling Table, p.f.
Kearney & Trecker Attachment for Milling Bridge Reamers, 62" long & 24" wide
1¼" Cincinnati Rack Milling Attachement for No. 3 Dial Type Miller
Rack Milling Attachment for No. 5 Cincinnati H.P. Miller
Cincinnati Universal Spiral Milling Attach. for No. 2 Dial Type Miller
16" Kearney & Trecker Rotary Table, p.f.
36" Cincinnati Power Feed Rotary Table, m.d., for Vertical Hydro-Tel
Cincinnati Universal Vertical Attachment for No. 5 Miller
36" square Lucas rotary table

SHAPERS

12" Vernon Plain Crank Shaper, m.d., late type
16" Cincinnati Back Geared Crank Shaper, m.d.
16" Queen City H.D. Back Geared, Crank Shaper, cone
16" Smith & Mills Plain Crank Shaper, cone
24" Potter & Johnston, cone
32" Columbia Back Geared Crank Shaper, m.d. thru gear box
32" Morton Draw-Cut, m.d., late
36" Morton Draw-Cut, m.d., late
48" stroke Heavy Duty Morton Traveling Head Draw-Cut Shaper, m.d., with d.c. variable voltage equipment, 12' bed, latest type

SHEET METAL MACHINERY

No. 3 Hilles & Jones Plate Bending Rolls, m.d.
No. 2 Campbell Nibbler, m.d.
Gray Turret Head Metal Cutter, cap. ¼", 36" throat
No. 2 Liberty Nibbler, 28" throat
Southwark Rotary Metal Cutter, 36" throat, m.d.
120" No. 100 Niagara Heavy Production Folder, 16 ga., m.d.
No. 3—⅛" cap. Gray Sheet Metal Cutter, m.d.
8' No. 196 Robinson Power Squaring Shear, m.d.

SLOTTERS

10" Newton, cone
12" Bement-Miles, m.d.
15" Canada, m.d.
20-24" Dill, m.d.
48" Niles-Bement-Pond Geared, m.d.

TAPPERS

No. 1 Bakewell Precision, m.d.
No. 1R Bakewell Precision Radial Tapper, m.d., latest
No. 2 Bakewell Precision, m.d.
Baush Radial Drilling & Tapping Machine, m.d., latest
No. 5 Webster & Perks, belt
No. 10 Kaufman High Duty Oscillating Pneumatic, m.d.

MISCELLANEOUS

Cincinnati Four Spindle 360° Automatic Profiling Machine, m.d., automatic tracing attachment, latest
Gorton Munitions Engraver, hand operated
Gisholt Precision Balancing Machine, m.d.
Detrick & Harvey 2 spindle Profiler
No. 12M Morey 2 spindle Profiler, m.d., latest
30" Pratt & Whitney Vertical Miller & Profiler, m.d., model M1482
No. 12 Pratt & Whitney 2 spindle Profiler, m.d.
No. 20 PH A.D. Cook Deepwell Pump with Chrysler Engine and 200' of 8" pipe, brand new
Wagner Saw Sharpener, m.d.
Gogan Hardness Tester, Model 1618
Logan Hydraulic Vertical Shaver, m.d.
No. 1 Fischer Oil Groover, m.d.

TURRET LATHES AND SCREW MACHINES

No. 1H6 Libby, m.d., chucking, latest
No. 1 Cincinnati-Acme, Semi-Universal, m.d., chucking, Timken
No. 1F Foster Fastermatic, m.d., Timken
No. 1L Gisholt Universal, m.d., chucking, Tim.
No. 1 Warner & Swasey "Electric" Turret Lathe, m.d., bar, Timken
No. 1A, 2A, 3A Warner & Swasey Universal, bar and chucking types
No. 2A, 3A Warner & Swasey Universal, chucking, Timken
No. 2B Foster Universal, m.d., chucking
No. 2B Foster Universal, m.d., bar, Timken
No. 2F Foster Fastermatic, m.d., Timken
No. 2G Morey, bar, m.d., latest
No. 2L Gisholt, m.d., chucking, standard and long bed types, Timken
No. 2 Simmons Micro-Speed Turret Lathe, m.d.
No. 3 Cincinnati-Acme Full Universal, m.d., chucking
No. 3 Foster Geared Head, m.d., bar
No. 3B Foster Universal, m.d., bar
No. 3F Foster Fastermatic, m.d., Timken
No. 3 Gisholt Ram Type Universal, m.d., Timken, late
No. 3L Gisholt, m.d., chucking, Timken
No. 3L Gisholt, with cross sliding turret
No. 3 Warner & Swasey Universal, m.d., chucking, latest
No. 3A Warner & Swasey Universal, m.d., chucking, latest
No. 4R Cincinnati Acme, m.d., bar
No. 4 Gisholt Universal, m.d., chucking, Tim.
No. 4 Warner & Swasey Plain, cone, bar and chucking types
No. 4 Warner & Swasey Universal, m.d., chucking
No. 4A Warner & Swasey Universal, m.d., chucking
No. 4FU Foster Fastermatic, m.d., latest
No. 5.0 Acme Universal, m.d., designed for glass bottle work, latest
No. 5 Bardons & Oliver Universal Ram Type, m.d., chucking, preselector head, latest
No. 5 Foster Universal Geared Head, m.d., chucking
No. 5 Gisholt Ram Type Universal, preselector head, m.d., Timken, latest
No. 5 Warner & Swasey Universal, m.d., chucking
No. 7 Bardons & Oliver Universal, m.d., chucking, late
No. 7 Bardons & Oliver, cone
2½"x24", 3x36", 3½x32", 4x34", Jones & Lamson Geared Head, m.d., bar & chucking types
3¼" Cincinnati-Acme Geared Head Flat Turret, chucking and bar types
18" Libby Type A, m.d., chucking
20" Acme, cone
24", 28" Gisholt, cone
26" Libby Type C, m.d., chucking
25 Woods Tilted Turret, Model D, Cone

PRESSES

48x36" Chambersburg Cecostamp Air Operated
C5 Ferrocute O.B.I. Power Press, flywheel type, m.d.
Ferrocute Double Crank, 36" between uprights, 84 ton cap.
96"—400 ton Niles Driving Wheel Press, m.d.
Chambersburg 30 ton Hypro Pneumatic
Metalwood B 33, B 45
No. 7 and 8 Thomas Punches, latest
No. 2 Hilles & Jones Horizontal Punch, m.d.

SAWS

7½ H.P. Cincinnati Elec. Tool Co. Abrasive Cut-off Machine, type JCAW
No. 3 and 8 Nutter & Barnes Cold Saws
No. 6 Cochran Bly Cold Saw
No. 138 Espen Lucas Cold Saw, m.d.
Gustav Wagner Cold Saw, m.d.

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio
MElrose 1241
CABLE ADDRESS
EMCO

LATEST TYPES — GUARANTEED MACHINE TOOLS 1941-1950 MODELS

MILLING MACHINES
CINCINNATI: 2-spindle Vertical Hydrotel with two rotary tables.
CINCINNATI: #2M Vertical, Rotary table, P.F.
CINCINNATI: 6-S Vertical
SUNDSTRAND: #6 Rigidmil—Duplex (for milling cam tracks in propellor hubs or similar work)
SUNDSTRAND: #60 Rigidmil—Hydraulic
SUNDSTRAND: #6 Rigidmil
MOREY: 12M 2-spindle Profiler
TAYLOR-FENN: M-48 Duplex Selfeed
TAYLOR-FENN: Vertical 6"x21" Table, power feed
RICE-BARTON: Duplex Selfeed
VAN NORMAN: 10CT Contour Miller

THREAD MILLERS & TAPPERS
MOREY: 12"x60" Thread Miller
LEEB BRADNER: 49A Thread Miller
LEEB BRADNER: LT 6x36" Thread Miller
HALL PLANETARY: B, C & D Thread Millers
MURCHEY: #22 Tapper, Horizontal
PRODUCTO: Hand Tapper
NATCO: Vertical Tapper 16 spindle

TOOL SHARPENERS
OLIVER: 2A Face Mill Grinder
OLIVER: 818 Drill Sharpener
OLIVER: 10" Tool Bit Grinder Template Type
FELLOWS: Flat Top Helical Gear Cutter
RANSOM: 2-wheel grinder 5 HP

GRINDERS—THREAD
EXCELLO: #31 & #33 External
JONES & LAMSON: TG846 External
JONES & LAMSON: TG1340 External

GRINDERS—CYLINDRICAL
NORTON: 9"x18" & 10"x18", Plain
NORTON: 18"x18" 45° angle wheel head
NORTON: 12"x30" Universal
LANDIS: 10"x18" "O" Plain Hydraulic
LANDIS: 18"x32" Type "D" Crankpin, Hydraulic
CINCINNATI: #2 Centerless
CINCINNATI: 6"x16" Hydraulic Filmatic
BROWN & SHARPE: #10 & #23 Plain

GRINDERS—INTERNAL
BRYANT: #3 and #8Y Internal
BRYANT: 10D10 Internal
HEALD: #36 Planetary
HEALD: 78A Plain Internal
HEALD: 72A5 T-bed, Universal.
HEALD: 72A5, 72A5 Plain & Universal
HEALD: 72A3 Sizematic Centerless
HEALD 72A5 Sizematic
HEALD 172 Sizematic for Cylindrical Cams
BRYANT: 112 Universal, Hydraulic
BRYANT: 10-28 Hole Grinder
BRYANT: 24-30 Heavy Duty Internal
RIVETT: #104 Tool Room Universal

GRINDERS—RADIUS
VAN NORMAN: #79, 630, 949 Oscillating
VAN NORMAN: #3½ Universal

GRINDERS—SURFACE
ARTER: A-1-8" Rotary
THOMPSON: 8"x12"x18" Type B
THOMPSON: 12"x18"x36" Type C
HEALD: Rotary 8" dia. chuck
HEALD: #22 Rotary—12" Chuck
GARDNER: 120A Opposed Head Disc

HONING & LAPPING
BARNES: 300 H Vertical Honing
MICROMATIC: H-310 Double End Horizontal
MICROMATIC: H-3 Single End Horizontal
NORTON: #26C and 29F Hydrolaps
NORTON: #2Fx40" Diameter Lapper
SCHRANER: External Cylindrical Lapper with six Heads Model A.

GEAR & SPLINE GRINDERS
PRATT & WHITNEY: 19" single & double wheel
GEAR GRIND MACH: GG-19 (19"x24"). Hydraulic Spur Gears & Sellons also Internal
GLEASON: #17 Spiral, Zerol & Hypoid Bevel
MAAG: 8X32 11¾" diameter

GEAR CUTTING MACHINES
BARBER-COLMAN: #3 Hobber
BROWN & SHARPE: #6 Cutter—72" diameter
CLEVELAND: 140 Hobber—1 spindle
FELLOWS: 822 Shaper
FELLOWS: 6I, 61A, 64A, 7 & 72 Gear Shapers
FELLOWS: Straight Line Generator
GLEASON: 6" Straight Bevel Gear
GOULD & EBERHARDT: 12H Hobber, 18" dia.
GOULD & EBERHARDT: 36MM Cutter
HAMILTON: #1 Hobber 9" diameter
SYKES: Gear Machinery (all sizes)

GEAR FINISHERS & TESTERS
FELLOWS: 6LSI & 15LSI Gear Lappers, External & Internal, Spur & Helical
FELLOWS: #4 Fine Pitch Shaver 4" diameter
FELLOWS: #12-C Spacing Tester
GLEASON #13 Universal Gear Tester
GLEASON: #4 & #6 Bevel Gear Testers, Hand & Power Operated
GLEASON: 5" Bevel Gear Tester
ILLINOIS: 814 Center distance & concentricity checker
ILLINOIS: 604 Bevel Gear Hand Rolling Fixture
ILLINOIS: #224 Involute Checker and Recorder
RED RING: 810-12" Gear Tester
FELLOWS: #5M Rod Liner

PRECISION BORING
BARNES: #412 Horizontal 60" Travel
HEALD: 48A Single End 2-spindle
HEALD: 47A Single End 2-spindle
HEALD: 46B Double End Borematic

LATHES—PRODUCTION
POTTER & JOHNSTON: 84D Automatic
SUNDSTRAND: 0x15 & 12x22 Auto. Lathes
LODGE & SHIPLEY: #3A Dumatic
LIPE-ROLLWAY: 18"x30" Carbomatic
LEBLOND: 23"x48" Engine Lathe, raised to 40"

LATHES—TURRET
BULLARD: 24", 30" Vert. Spiral Drive
WEBSTER & BENNETT: Vertical Turret Lathes 18", 48" and 60" sizes
GISHOLT: No. 4 and 5, Ram Type
HERBERT: Turret Lathes (all sizes)

DRILLING MACHINES
AVEY: #2 Deep Hole Hydraulic
LELAND-GIFFORD #2LMB Deep Hole Vertical
BARNES: 20H½ 2 spindle on 4 spindle base
BAKER: 36HO 2 spindle inverted 4" dia. cap.
BAKER: 21U Upright Heavy Duty 2" dia. cap.
FOSDICK: #48M Upright High Speed
PROVIDENCE ENG: 6-spindle ⅝" capacity
PRATT & WHITNEY: ½-8x30 Deep Hole Reamer
ARCHDALE: Radial, all sizes (6ft.)

MISCELLANEOUS
CINCINNATI: 2-36 Bronaloy Machine
BLOUNT: Polishing Lathe 12x48
GARDNER: #6 Disc Grinder
ALLEN: #2 Stud Setter
CAMPBELL: #420 Abrasive Cutalator
WILLIAMS: 10" Pipe Cut-Off
TANNEWITZ: GH-36 Band Saw High Speed
KENT: 3½" Bar Pointer and Chamfer
MATTHEWS: 70A Marking Machine
GENERAL: #33 Flexible Shaft
DENISON: 018-AM Hydr. Tool Stand
OSBORN: 902 Jolt Rollover for Foundry
GENERAL ENG.: Riveter 24" throat

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75 WEST ST. Cable Address: "TRIMACTOOL" NEW YORK 6, N. Y.

LATE MODEL MACHINE TOOLS . .

AUTOMATICS
No. 49 New Britain Chucker. 1941
20"x25" Fay Automatic. 1945.
No. 12"x21" Fay Automatic. 1942.

BOLT MACHINES
No. 500C Manville Thread Roller. Latest.
No. 250C Manville Header, SSSD. Latest.

BORING MACHINES
62" King Vertical. 1942.
48" Heald Single End. 1943.

DRILLS
No. 25HD Baker. 1942.

GEAR EQUIPMENT
No. 6 Gleason Revacycle. 1941.
No. 6 Gleason Testers. 1943.
8" Red Ring Internal Shaver. Late.
No. GCL-3 Red Ring Shaver. 1942.
No. 01A Fellows Gear Shaper. 1942.
No. 72 Fellows Shaper. 1943.
Red Ring Univ. Checker.

GRINDERS, CYLINDRICAL
16"x36" Cincinnati Plain. 1942.
12"x30" Landis Univ. 1941.
10"x18" Norton Plain. 1942.
6"x30" Landis Plain. 1942.

GRINDERS, SURFACE
30"x24"x192" Mattison. 1943.
14"x36" Pratt & Whitney. 1943.
8"x24" Thompson Hyd. 1942.

GRINDERS, INTERNAL
No. 24-36 Bryant Hyd. 1943.
No. 172 Heald Gap. 1940.
No. 72A3 & A5 Heald Rotary. 1943.
No. 73 Heald Hydraulic. 1942.

LATHES, ENGINE
27"x96" LeBlond. 1942.
18"x120" Lehmann, G. H.
16"x54" Reed-Prentice. 1942.
12"x30" Monarch. 1942.

LATHES, PRODUCTION
No. 3A L&S "Dumatic." 1943.
8"x108" La-Swing Semi. Auto. 1942.
14"x42" Monarch "Magna-Matic." 1941.

LATHES, TURRET
8½"x24" Acme Univ. 1943.
No. 5.0 Acme Univ. 1942.
No. 3R Gisholt. 1943.
No. 1H-5 Libby. Late.
No. 6R Denser. 1942.

MILLS, PLAIN
No. 3B Brown & Sharpe. 1941.

MILLS, PRODUCTION
No. 1-14 & 2-20 Kent Owens. 1942.
No. 34-36 Cincinnati. 1942.
No. 1-18 & 2-24 Cincinnati. 1942.

MILLS, THREAD
6"x36" Loca Bradner. 1942.

MILLS, UNIVERSAL
No. 3 Cincinnati, D.T. 1945.
No. 2MH Cincinnati. 1942.

MILLS, VERTICAL
No. 4H Milwaukee. 1942.
No. 8½ D Gorton. Late.

PRESSES
300 Ton Lake Erie, Hyd. 1945.
50 Ton Denison, Hyd., Str. 1942.
56 Ton Niagara O.B.I. Late.

SHAPERS
20" Cincinnati Plain. Late.
6" Pratt & Whitney. 1942.

WELDERS
150 KVA Federal Seam. 1943.
60 KVA Sciaky Spot. New.

Write for latest stock list

INDIANAPOLIS Machinery & Supply Co.
1961 S. Meridian St. . . Indianapolis, Indiana

UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 3—26" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Pinner type 16"x26" Surface 12"x63", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—16"x5', 5', 10'—10"x6', 8', 10'—12"x8', 6', 10'—20"x10'—all open drive, several motorized also (new) 10"x8' and 10' geared head, motorized.
Large stock 19" and 18" bench and floor type.

Planers—Single head 24"x8', 24"x8', 26"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 3"x24"—6"x20" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 42".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 5¼" from center of shaft to flatted top (1 h.p. to 10 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x16' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty joiner, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

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BEAVER-BILT*
Brown & Sharpe Automatic Screw Machines
Guaranteed to Operate the Same as New

THE FOLLOWING LATE TYPE, HIGH SPEED BROWN & SHARPE AUTOMATIC SCREW MACHINES ARE NOW IN STOCK FOR IMMEDIATE DELIVERY AT A FRACTION OF ORIGINAL COST.

1—No. 0G H.S. Serial No. 10349 Swing Stop, ¾" Spindle Cap., 4150 R.P.M. Spindle Speed, Motor in base. 1943. Beaver-Bilt.

1—No. 2G H.S. Serial No. 12125 Swing Stop, Vertical Cutoff Slide, Oversize Feed Tube, 1¼" Spindle Cap., 3000 R.P.M. Spindle Speed, Motor in base. 1946. Beaver-Bilt.

Each of the above machines is Beaver-Bilt and complete with the following standard equipment—Standard Capacity Feed Tube—Front and Back Circular Tool Posts—Work Pan—Wrench Rack—Turret Hand Lever—Full set of Feed Change Gears—Full set of Spindle Speed Change Gears—Stock Stands—Complete set of Oil Splash Guards.

TRADE-IN SPECIALS IN GOOD OPERATING CONDITION

5—No. 00 Standard B. & S. Automatic Screw Machines Serial Nos. 6430, 6460, 7268, 7821 and 8062 complete with countershafts and standard equipment. Very clean machines.

1—No. 00 High Speed B. & S. Automatic Screw Machine Serial No. 2526 with High Speed Roller Bearing Spindle and Motor Drive with motors. This machine was recently rebuilt.

1—No. 00 High Speed B. & S. Automatic Screw Machine Serial No. 7402 complete with High Speed Roller Bearing Spindle and Lima Motor Drive, also standard equipment. This machine is in excellent rebuilt condition.

1—No. 0 Standard B. & S. Automatic Turret Forming Screw Machine with standard equipment and countershaft.

5—No. 0 Standard B. & S. Automatic Screw Machines Serial Nos. 2775, 5263, 5525, 5526 and 6523 complete with standard equipment and countershafts.

1—No. 0 High Speed B. & S. Automatic Screw Machine Serial No. 5501 complete wtih High Speed Roller Bearing Spindle and Turner Motor Drive, also standard equipment. In very good operating condition.

3—No. 2G Standard B. & S. Automatic Screw Machines Serial Nos. 2379, 2402 and 4310 with Geared Heads and Single Pulley Drives. Very clean machines.

1—No. 2 Standard B. & S. Automatic Turret Forming Screw Machine Serial No. 2862 complete with countershaft and standard equipment.

1—No. 2 Standard B. & S. Automatic Screw Machine Serial No. 3348 complete with Turner Motor Drive and standard equipment.

4—No. 2 Standard B. & S. Automatic Screw Machines Serial Nos. 2702, 3174, 4437 and 5026 complete with standard equipment and countershafts.

1—No. 2 Standard B. & S. Automatic Screw Machine Serial No. 5093 complete with Berkeley Motor Drive and standard equipment. This machine is in excellent condition.

OTHER FINE MACHINE TOOLS

1—No. 0 B. & S. Hand Screw Machine Serial No. 1504 with motor in base and standard equipment. 1940 machine. Excellent condition.

1— New Jacobson Cam Cutting Attachment mounted on a No. 3 size Oesterlein Milling Machine. Motor Driven, for cutting all size cams for Brown & Sharpe Automatic Screw Machines—excellent condition.

6— Elgin Precision Jewelers Bench Lathes, 7" x 16" Capacity, complete with 3 Jaw Chucks, Dog Plate, Face Plate, Draw Bar, Compound, Tail Stock, Grinding Attachments, 6 foot heavy Maple Benches, and Motor Drives with Motors. New 1945 and in excellent condition.

6— Hardinge Second Operation and Hand Screw Machines, bench type, with Collet Type Headstocks and Six Hole Turret Index Type Tail Stocks, New 1945 and in excellent condition.

*Not Just RE-Built — But BEAVER-BILT!

1. Beaver-Bilt Machines are *unconditionally guaranteed* to produce work to the same tolerances as a new machine of the same type.
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3. Beaver-Bilt Brown & Sharpe machines save you up to 50% of the cost of a new machine of the same type.
4. Each machine is properly skidded, crated, and loaded on a truck free of charge.

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Any Beaver-Bilt or "as is" machine sold by us can be operated in your own shop for a period of 30 days and, if found unsatisfactory for *any reason whatsoever*, may be returned freight prepaid for a full refund of the purchase price.

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No. 40-5 Minster Straight Side, Double Back Geared Press.

No. Buffalo Steel Billet Shear, 5½" round capacity.

No. 10 Buffalo Steel Bar Cutter, 3½" round capacity.

50 Ton Henry & Wright Dieing Machine.

No. C82 Ferracute Notching Press.

No. 4½ R & K O.B.I. Press, 4½" stroke, M.D.

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16"x60" PRATT & WHITNEY Toolroom Lathe

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24"x24' LODGE & SHIPLEY Lathe, 18' centers

7D JONES & LAMSON Flat Turret Lathe, pre-selector head, 1942

Model R-14 SENECA FALLS "Le-Swing" Lathe, 16"x40", automatic timing, 1941

No. 12 BROWN & SHARPE Automatic Milling Machine, 1942

No. 2M CINCINNATI Universal Mill, rectangular overarm, motor in base, dividing head

No. 2 CINCINNATI Dial Type Vertical Mill, 1941

No. 3 CINCINNATI Dial Type Plain Mill, Vertical Head, 1941

4" TAYLOR & FENN Duplex Spline Mill, 1942

No. 31 LUCAS "Precision" Table Type Horizontal Boring Mill, 3" bar

84" CONSOLIDATED COLBURN Vertical Boring Mill, 2 swivel heads, rapid traverse, AC—MD

No. 5 GALLMEYER & LIVINGSTON 12"x36" Surface Grinder

5"x40" Type C LANDIS Semi-Automatic Hydraulic Camshaft Grinder

72A3 HEALD Internal Grinder, 1943

13"x13" PEERLESS Hacksaw, AC—MD, 1938

27"x36" AMERICAN Wheelabrator Tumblast Machine, 1943

7A FELLOWS Gear Shaper, 1943

1½"—8" JARECKI Pipe Machine, 1943

No. 0 BROWN & SHARPE High Speed Automatic Screw Machines, Turret drives, serial nos. 6013, 7948, 8329

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Putnam 18" Vert. Slotter.
B & S No. 4 Auto. Screw Mach.
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Producto Hand Mills, M.D.

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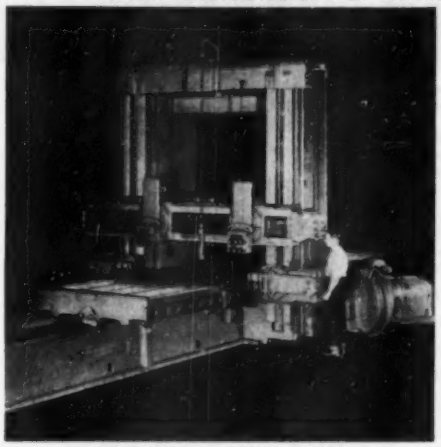
from AMERICA'S *FINEST* STOCK OF PLANERS



SELLERS "POWER-FLOW" PLANER

SELLERS 60"x60"x12' DOUBLE HOUSING Planer "POWER-FLOW"—

Max. width between housings—62"
Max. height under cross rail—62"
Length of table—14'3"; length of bed—27'
Speeds from 7' to 200' per minute
Equipped with—power rapid traverse, 2 swivel heads on adjustable cross rail, 2 swivel side heads, electric clapper box and lifts—direct vari-voltage drive including all motors and electrical starting equipment

MANY OTHER HIGH-GRADE PLANERS IN STOCK, including—

BETTS 84"x92"x14'—4 heads
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DETRICK & HARVEY 48"x48"x16'—4 heads; hydr.
LIBERTY 48"x48"x16'—4 heads; VARI-VOLTAGE DRIVE
LIBERTY 72"x48"x20' convertible openside (latest type)—4 heads; VARI-VOLTAGE DRIVE
NILES 30"x30"x10'—Latest Type—3 heads
NILES BEMENT POND 72"x72"x30'—4 heads
NILES BEMENT POND 96"x96"x24'—4 heads
NILES BEMENT POND 108"x84"x42'—4 heads
WOODWARD & POWELL 54"x54"x20'—4 heads

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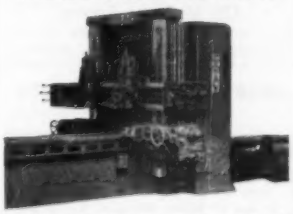

48"x48"x12' GRAY PLANER: NEW 1941 4 Heads, M.D.
10x48" NORTON TYPE "C" HYD. CYL. GRINDER: NEW 1941, M.D.
14"x48" MATTISON HYD. SURFACE GRINDER: M.D.
NO. 11 BLANCHARD VERT. SURFACE GRINDER, NEW 1945, 16" Mag. Chuck.
NO. 15-48 DBLE. RAM VARIABLE SPEED, LA POINTE VERT. HYDR. SURFACE BROACH, NEW 1948. 15 TON, 48" STR.
5" BAR SELLERS, Tble. Type Horiz. Boring Mill, 36"x72" Tble. NEW 1942.
NO. 5 CINCINNATI PLAIN MILL, Grd. Head HIGH POWER, New 1942, 79"x21" table.

Only Partial Listing—
Over 2,000 Machines in Stock

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Machinery Co., Inc.
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RARELY AVAILABLE

Priced Low Before Removal

1—Wickes 20' x 5/8"—3/4" Plate Bending Rolls—power elevation—drop end—motor driven

1—R. D. Wood 300 Ton Hydraulic Sectional Flanging & Joggling Press—3 rams—all steel—New 1943—like new

1—Quickwork #6 Rotary Shear—Cap. 1"—48" throat—motor driven

1—Niles 24' Plate Edge Planer—Pneumatic holdowns—motor driven

1—Cleveland #Z Single End Punch or Solid Back Press—Cap. 750 tons—Shear 6" round—8" x 8" x 1½" angles—motor driven

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OPPOSED HEAD DRILL
FOOTBURT SINGLE SPINDLE HORIZONTAL DRILL, WITH TWO OPPOSED HEADS, WILL DRILL UP TO 3½" CAPACITY.
COMPLETE WITH 15 HP DC MOTOR DRIVE.
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NEW CHUCKS
Ten—New 32" Union 4 Jaw Independent Chucks, Steel Body, Reversible Jaws, D1-8 Mount. Packed in Original Boxes.
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OUR PRICE ..... $ 475.00
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GEAR MACHINERY

No. 18-H Gould & Eberhardt Hobber, MD
No. 34 Brown & Sharpe Hobber, MD
32"x16" Cincinnati Hobber, MD
No. 1 Adams Hobber, arr MD
12"x18" Gleason Str. Bevel Gear Generators
No. 4-36 & No. 6-60" Brown & Sharpe Cutters
No. 4 Cincinnati Gear Cutter
No. 13 Brown & Sharpe Spur & Bevel Gear Cutter

GRINDERS

No. 2 Cincinnati Centerless, MD
No. 2 Diamond Surface
No. 3 Abrasive Surface
No. 16-26 Blanchard, MD
No. 25A Heald, 28" chuck, MD
10"x18" Norton Type C Plain Cylindrical, new 1943

BORING MILLS

36" Bullard "New Era" Vert. Turret Lathe
36" Rogers IT-36 Vert. Turret Lathe, new 1941
48" Gisholt, Vert., 2 heads
No. 21 Lucas Horz., 2¾" bar
No. 3A Universal Horz., 3" bar

LATHES

14"x30" ctrs Lodge & Shipley Selec. Grd. Hd., MD
14"x56" ctrs LeBlond Gap, MD
16"x32" ctrs Sidney Grd. Hd., arr MD
17"x50" LeBlond, MD
20"x94" ctrs American Grd. Hd., MD
24"x72" ctrs Bridgeford, MD
30"x127" ctrs Lodge & Shipley, cone
36"x270" ctrs Lodge & Shipley Trip. Grd. Selec. Hd., MD, two carriages, taper

MILLERS

No. 2 Cincinnati Universal, cone
No. 2 Brown & Sharpe Heavy Plain, arr MD
No. 3B Milwaukee Universal, SPD
No. 3 Cincinnati High Power Plain, MD
No. 4 Cincinnati High Power Universal, MD
No. 4 Ohio Plain, MD

SHAPERS

21" Smith & Mills B. G., cone
20", 24", 28" Gould & Eberhardt, MD

TURRET LATHES

No. 601-WD Oster "Rapiduction", MD, late
No. 2 Cincinnati-Acme Grd. Hd., MD
No. 4 Warner & Swasey Grd. Hd., MD

MISCELLANEOUS

400-ton Niles-Bement-Pond Wheel Press, MD
2½" Cone 4-spindle Automatic, MD
No. 6A Marvel Hack Saw, automatic feed, 1943
No. 5 Baker Keyseater
10" Pratt & Whitney Vert. Shaper
No. 9-SP-BS Buffalo All-Steel Bar Shear, new 1941
Jackson Die Sinker, cherrying attach.

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OFFICE AND WAREHOUSE: 311-313 Bakewell St. Covington, Kentucky
Three minutes from the Cincinnati hotel district

FOR SALE

The following equipment in excellent condition. We invite your quotations:

4—Natco Holesteel, multiple drill, 36 spindle, with air operated tables. Adjustable multi-spindle vertical driller and tapper.
1—Heald No. 22 Rotary Surface Grinding Machine, belt drive to chuck, 12" dia. capacity magnetic chuck
1—Heald No. 22 Rotary Surface Grinding Machine, 12" dia. capacity magnetic chuck.
1—Cincinnati No. 0-B Vertical Milling Machine with rotary table.
1—Milwaukee Simplex Milling Machine, 24" table feed, 42" long table.
1—Baush Horizontal Boring Machine, double end way type, size 30 heads, 10 HP.
1—Baush Horizontal Boring Machine, double end way type, size 30 heads, 7.5 HP.

Subject to withdrawal and subject to prior sale.

FS-8238, AMERICAN MACHINIST
520 Michigan Avenue
Chicago 11, Illinois

LATHE—Engine, Mackintosh-Hemphill, 72"/110"x30' Centers (1943)
VERT. MILL—Cinc. Hydrotel #28/60, 4-spindles, Tracer (1942)
CRANE—150 Ton x 30' span, Whiting, Bridge, 3 hook trolley.

BORING MILLS—D & H 3½" horiz. floor
Vertical Turret Lathe, 30"
Bullard, 72", 2 swivel heads on rail (old)
CRANE—Overhead, 3 Ton x 30', floor control
DRILL PRESSES—Minster #2D, 2½" cap. Hvy.
Snyder, 1½", 28" swing
GEAR SHAPERS (2)—Fellows #6
GRINDER — Surface, Reid Model 2-1 (late)
INDUCTION HEATER—Lepel 7½ KW
LATHES—Engine, Logan 10"x4' cabinet (late).
Engine, Sebastian 16"x36" centers (late)
Turret, Foster #1B Universal, Chucker
Turret, Midland #5 Air Chucker (late)
MILLERS—Newton, Vert. 42" Rotary Hvy.
Cinc. #3 Vert. Hi Power
Br. & Sh. #3 Universal
Cinc. #08 Vert. (late)
PUNCH—Sq. end, Smith 1-1/16" thru ⅝"
ROLLS, Angle—Bertsch 3"x3"x⅜"
ROLLS, Bending—H. & J. 30'x¾", Pyr.
Southwark 15'x3", Vert.
SHEARS—Square—Woods 7'x1" Hydr, gap
Alligator—(#2) 24" blade, 3" Rds.
Rotary — Quickwork #50A, 48"x¾" (late)
THREAD MILLS—Morey 12"x10' Centers (late)
Lees-Bradner 9"x36" centers
THREADER—Bolt—Acme 2½" cap.
WELDER—Spot, 75 KVA, Federal (late)
PRESSES—Z & H #7, 50 ton percussion
Bliss #78½, 450 ton, 18" stroke
W. F. #104A Horiz., 50 ton, shell drawing.

KINGS COUNTY MACHINERY EXCHANGE
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EVERY ITEM GUARANTEED
All Late Type

54" Bullard Vert. Turret Lathes (2), latest type
5" Giddings & Lewis Boring Mill, #45T with Detroit Universal Duplicator
4" and 6" Sellers Horizontal Boring Mill
3" Universal Horizontal Boring Mills (2)

40"x15' LeBlond Engine Lathe, latest type
Bullard Multomatics, 16", 12", 8", late
Sgl. Spdl. Clearman (1949)
Sibley (1941) Drill Presses, #5 M.T.
#28/60 Cincinnati Hydrotel 4 Spdl., '44
9/16", 2¼", 2⅝" RA6 Acme Gridley Auto.
20" Gould & Eberhardt Shaper
Hardinge Multipurpose Chucking Machine, 1950
60" Bickford Vertical Boring Mill
75 Ton Henry & Wright Dieing Press
Kane & Roach 5 Station Roll Former

CHUCKERS
6" 6 Spdl. Acme Gridley and 6" 8 Spdl.
#865 New Britain Chuckers. (3)

PAULS MACHINERY COMPANY
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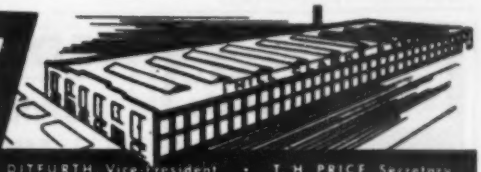
Phone: TYLER 7-6300

HILL-CLARKE
MACHINERY COMPANY



ESTABLISHED 1867 • H. W. MONS, President • W. L. DITFURTH, Vice-President • T. H. PRICE, Secretary

AUTOMATICS
No. 49 New Britain, 4 Spdl. Chucker

DRILLS
1, 2, 3, 4, 5, 6 Spdls Leland-Gifford, Allen, Edlund, Avey
No. 4BL Natco 36 Spdl. (1943)
No. 112 Defiance

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 61SA Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 72 Fellows Gear Shaper
No. 12 Gleason Bevel Gear Generator
No. 13 Brown & Sharpe Spur & Bevel
No. 1 Whiton Auto. Gear Cutter
No. 3 Barber-Colman Hob Sharpener

BORING MACHINES
No. 31 Lucas 3" bar, M.D.
Rockford—3½" Bar
No. 32 Giddings & Lewis 3½" Bar
No. 2 Lambert 4" bar
No. 46-B Heald Bore-Matic (1942)
No. DB-112 Excello—Single End—3 Hds.
No. DB-1212 Excello—Dbl. End, 4 Hds.
24" Bullard New Era
36" Bullard New Era
42" Bullard New Era
42" King
60" Colburn, M.D.
72" Niles-Bement-Pond
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" & 4"x18" Landis, Model H (1942)
6"x18" & 8"x20" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1942)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x72" Landis Type C Hydraulic
Norton Motorized Grinders ranging from 6"x18" to 24"x144"
No. 104 Rivett Univ. Gdr. (1943)
No. 5 Bryant Internal Grinder
No. 34 Abrasive Surface Grinder (1943)
No. 22—12" Heald Surf. Gdr.
No. 25-A Heald Surface Grinder
No. 72-A-3 Heald Internal (1942)
No. 72-A-5 Heald Internal (1942)
No. 74 Heald Internal (1942)
No. 18—38 Bryant Internal Gdr.
No. 24-26 Bryant Internal Gdr.
No. 81 Heald Centerless Internal

LATHES
18"x8' American, Gdr. Head, M.D.
18"x8' American Gd. Had.
22"—37¾"x48" Centers Monarch (1942)
24"-27"x22' Lodge & Shipley
36"x18" Betts—Bridgeford Grd. Head
10"x32" Sundstrand, Model AA (1943)
20" Fay Automatics (1942)
Model R-14 Seneca Falls Lo-Swing
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 6 Warner & Swasey, Bar Feed
No. 4B Libby (1943)
No. 1A Warner & Swasey, Bar Fd.
No. 4F Fastermatic (1942)

MILLING MACHINES
No. 3B Milwaukee Plain
No. 4 & No. 5 Cincinnati H.P. Plain
No. 3 Cincinnati Universal
No. 00 Cincinnati Vert.
No. 2½-B Milwaukee Vert.
No. 2 Cincinnati Dial Type Vertical (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-16 Cincinnati Mfg. (1942)
No. 2—10" Sundstrand-Electromil (1942)
No. 2—24" Sundstrand Electromil (1942)
No. 3-24 Cincinnati Hydromatic (1942)
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 56-72 Cincinnati Hydromatic
6"x36" Lees-Bradner—Model LT (1943)
12"x54" H.T. Lees-Bradner Thread Miller (1943)
10"x48" Hanson-Whitney Thread (1942)
48"x24"x13' Ingersoll Slab Miller
36"x24"x12' Ingersoll Duplex Miller (1946)
No. 10 Ingersoll 72"x6' Travelling Col. Face Millers (1942)
No. 36—120 Cincinnati Horizontal Hydrotel

MISCELLANEOUS
36" Ohio Shaper
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners

PLANERS
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36"x36"x18' Gray Maxi Service, 4 Heads
48"x36"x14' Gray
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144"x76"x48' Liberty Openside Planer

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No. 12 FELLOWS Gear Shaver.

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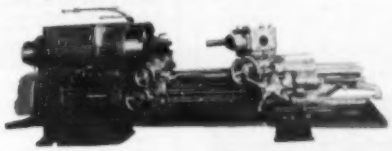

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WARNER & SWASEY #3A Universal (late). 9" Hole in spindle, swing 24½", bar feed & chucking equipment.
MOREY 36 Ram Type Plain, BG motor-in-base (late type), hole in spindle 1-9/32"—chuck cap. round 1", hex. ⅞"—wire feed.
OSTER #60IWD motor-in-base Turret Lathe—(late type)—auto. chuck cap. round 1⅛", square 1-1/16", hex. 1-5/16"—wire feed.

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Nos. 3 & 4 Cincinnati vertical
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Nos. 1H—12" & 12-24 Kearney & Trecker
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Barnes #3 Horiz. 3" Bar
P & N type Horiz., 4" bar
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American 24"x12' Geared Head, 12 speed
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Lodge & Shipley, 18"x8', 3 SCD, DBG
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Lodge & Shipley 18"x10', Patent Head
Lodge & Shipley 20"x8', Geared Head
Lodge & Shipley 20"x16', 5 SCD
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36-90 Cinci. Duplex Hydro. Miller, '42
No. 3 Cinci. Dial Vert. Miller, Late
No. 2M Cinci. Vert. Miller, 1942
No. 2LU Van Norman Univ. Miller, '42
2½" bar #287 G. & L. Table Hor. Bor. Mill
3" bar Yoder Table Hor. Bor. Mill, '42
6'17" sol. Carlton Radial, new 1943
5'14" sol. Amer. Tri. Purp. Radial, AC, M.D.
4'11" sol. Canady Otis Radial, '42
Barnes Combo. Boring & Honing Mach. up to 10' bore x 6" hole, 1942.
30"x120" Hanchett Plane Surface Grinder
12"x30" cen. Pratt Whitney Model B La., '43
14"/10½"x30" cen. L. & S. Lathe, T.A., '43
14/10½"x54" cen. Bradford La. T.A., '43
30"x20" cen. Axelson La., T.A., 36" swing
48"x20'0" cen. Simmons Lathe, 1942
40"x20' cen. Amer. La., 2 cur., 2 T.A.
16" Gemco Univ. Shaper, '43, gear driven
20" Smith Mills Univ. Shaper, New
No. 26 Moray Univ. Turret La., New
10'x10 ga. Cinci. Press Brake, 50 Series

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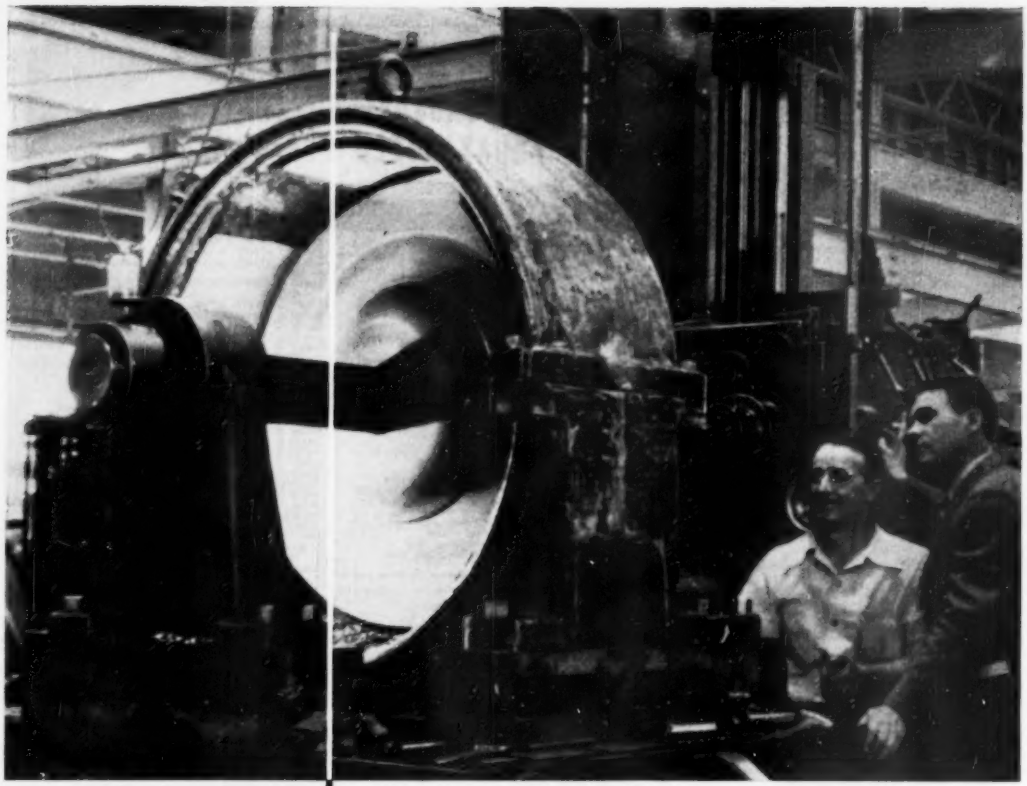

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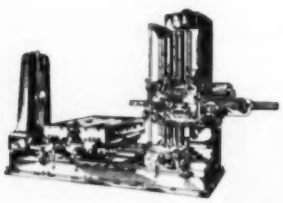

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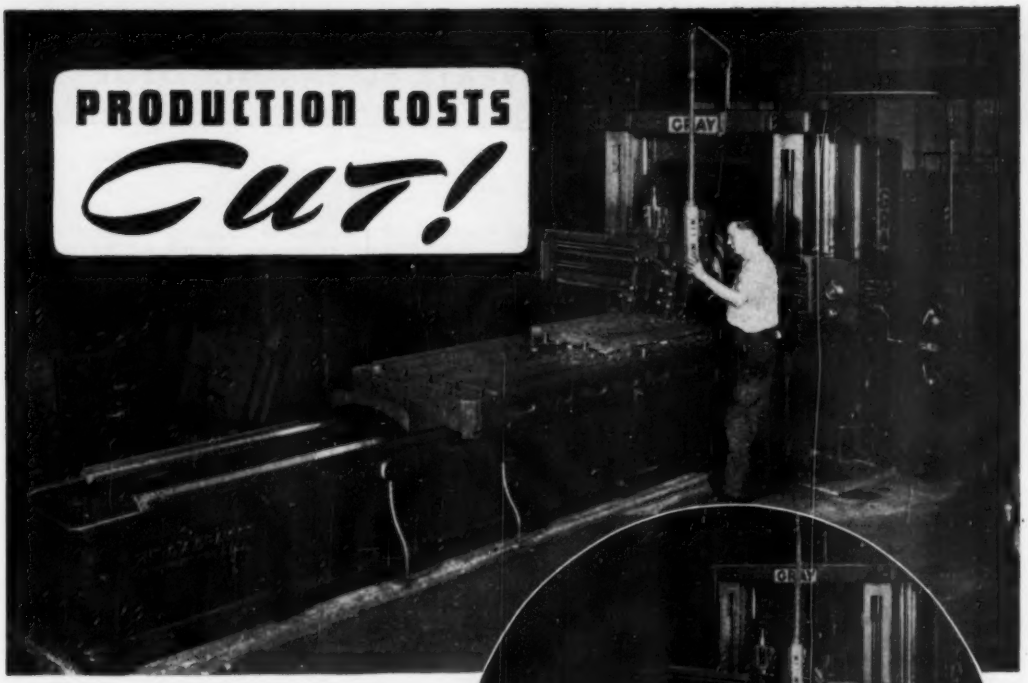

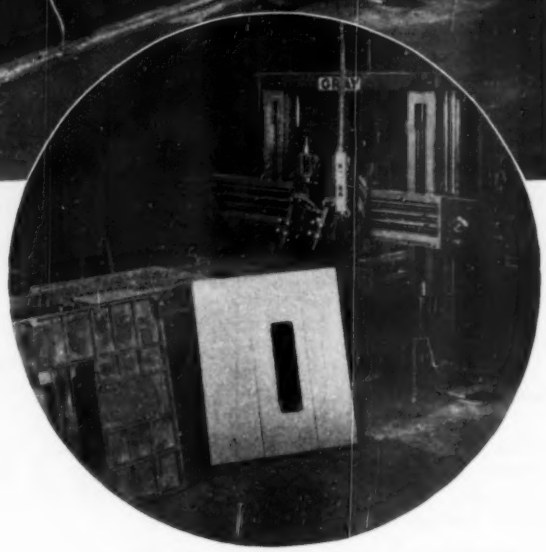

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Here are some typical savings:

	OLD TIME INC. SET UP	NEW TIME INC. SET UP	% INCREASED PRODUCTION
Rough Plane Small Wood Planer Table	2.9 hrs.	1.8 hrs.	61.0%
Rough & Finish Plane Large Lathe Bed	54.0 "	25.75 "	110.0%
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Rough & Finish Plane Small Lathe Bed	24.3 "	13.9 "	75.0%

And in addition, finish accuracy has been greatly improved!

FOR FASTER, BETTER PLANING—INVESTIGATE THE NEW GRAY

The G.A. **GRAY** *Company*

planers • milling planers
planer type milling machines
horizontal boring machines

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SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES

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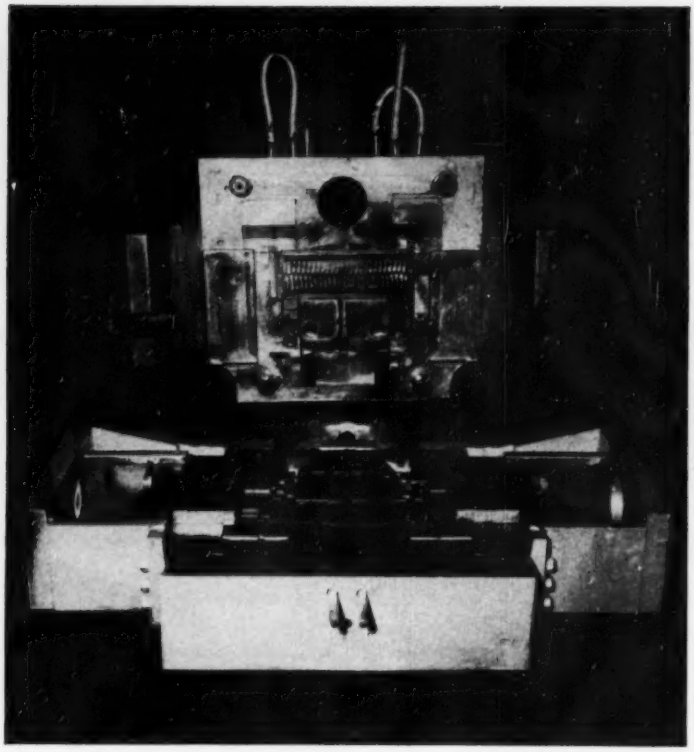

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Accuracy calls for POTOMAC M

HOT-WORK DIE STEEL

"HOT-WORK STEELS"

is the title of a new, six-page folder that tells about the chromium, molybdenum, vanadium Hot Die Steel known as POTOMAC M—and also covers other grades for other hot-work operations. Secure your copy —*write today!*

ADDRESS DEPT. AM-12

In the precision casting of aluminum, POTOMAC M Hot-Work Die Steel is especially favored as the material for die-casting dies because its properties help assure accuracy of the steel itself *after* heat treatment. Die makers have found that size changes are held to a minimum.

Dimensional stability is thus the *first* contribution that POTOMAC M makes to accuracy.

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Allegheny Ludlum makes a complete line of steels for hot-work tooling of various kinds—so, whether your need is the mass producing of duplicate parts or fabricating a few of them, call up "A-L" every time for hot-work counsel or service or both. Tell us your requirements.

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STEEL CORPORATION
Pittsburgh, Pa.

TOOL STEEL DIVISION: DUNKIRK, N. Y.

Fine Tool Steels Since 1854

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DEMPSTER DUMPSTER SYSTEM

SERVING COST-MINDED MANAGEMENT FROM COAST TO COAST

. . . handling bulk materials of every description at phenomenal savings

Photos show the three simple stages of servicing a container. The Dempster-Dumpster, operated from hydraulic controls by driver in the cab, picks up each container and hauls it to point of disposition where it may be dumped or set down intact.

—recognized across the nation

. . . Aluminum Company of America, well known for sound management, uses the Dempster-Dumpster System

Aluminum Company of America is among the hundreds of cost minded manufacturers, both large and small, using the Dempster-Dumpster System of bulk materials handling . . . the system recognized across the nation for its efficiency and ability to reduce costs.

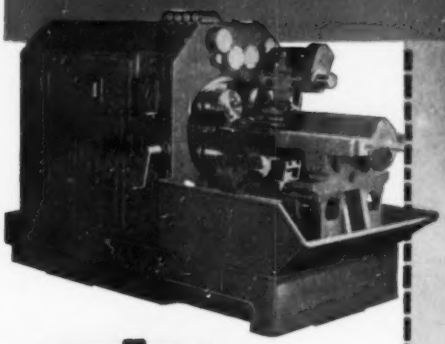
In the Dempster-Dumpster System one truck-mounted Dempster-Dumpster eliminates up to 10 conventional trucks because one Dempster-Dumpster services a great number of Dempster-Dumpster containers. These detachable containers, ranging in size up to 12 cu. yds., carry pay-loads equal to and greater than conventional truck bodies. They are built in a wide variety of designs best suited to handle any type of materials, be they bulky, light or heavy . . . solids or liquids . . . trash or rubbish. Containers are spotted at necessary materials accumulation points inside and outside buildings. The Dempster-Dumpster services one pre-loaded container after another.

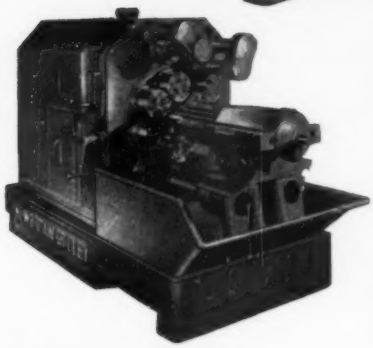
In addition to saving thousands of dollars annually in tires, gas, oil, and truck maintenance, the Dempster-Dumpster System eliminates standing idle time by truck and crews . . . eliminates handling and re-handling of materials . . . and increases efficiency and cleanliness. It will pay you to investigate the Dempster-Dumpster System now! A product of Dempster Brothers, Inc.

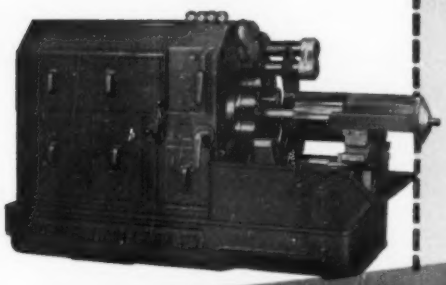
One Dempster-Dumpster Services All Containers. . . All Designs. . . All Sizes

DEMPSTER BROTHERS, 4110 DEMPSTER BUILDING, KNOXVILLE 17, TENN.

SPECIAL FEATURES...
mean better production methods







NEW BRITAIN *Automatic* 4-6-8 Spindle Chuckers

HYDRAULIC CHUCKING for simple positive control and rapid action. Chucking pressures automatically reduced in finishing positions, if necessary to prevent distortion.

FLAT CROSS SLIDES AND SWINGING TYPE FORMING ARMS make New Britains equally adaptable to heavy cuts and a wide variety of types of work.

SPINDLE STOPPING MECHANISM positions spindle automatically in loading position, or any other position necessary to perform work requiring a dead spindle. A safety device prevents carrier index before completion of chucking operation.

CARRIER LIFTING, LOCATING AND LOCKING MECHANISMS during index preserve initial accuracy by eliminating both wear and weave from the spindle carrier.

DOUBLE INDEX of spindle carrier with loading in two positions permits finishing both ends of a piece in a single cycle, or two pieces per cycle.

ACCELERATED OR DECELERATED MOTION, separate from turret, changes feed rate of any end working tool for different operations. Drill speeders in all positions.

ANTI-FRICTION BALL BEARING on hydraulic chucking distributor eliminates the wear and heat of metal-to-metal contacts and permits high spindle speed.

OPEN END CONSTRUCTION provides complete accessibility to the tooling area, and easy chip removal.

These important mechanical features are the basis for the adaptability and accuracy of New Britain chuckers and the new, better machining methods they make possible. May we send you the portfolio "It Can Be Done." It contains numerous cost histories showing the results in terms of cost-per-piece and pieces-per-hour. Frequent supplements are issued to those who request this valuable service.

649M J1

THE NEW BRITAIN MACHINE CO.

NB

NEW BRITAIN

Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

Honing machine with a 96-foot stroke gets precision with TIMKEN® bearings

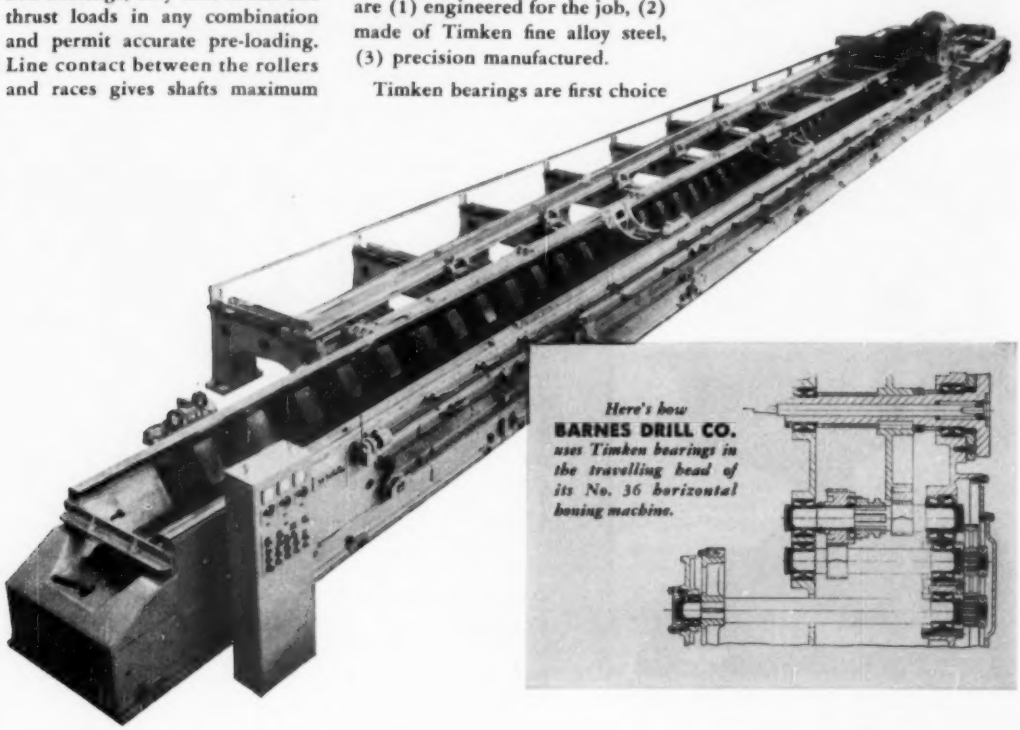
WHEN honing the inside of a long precision tube, a smooth-running spindle with steady, precise rotation is of major importance. That's why the Barnes Drill Company uses Timken® bearings on this No. 36 horizontal honing machine built for the Watervliet Arsenal. Eight Timken bearings are used in the headstock.

Due to the tapered design of Timken bearings, they take radial and thrust loads in any combination and permit accurate pre-loading. Line contact between the rollers and races gives shafts maximum support. Gears mesh correctly, vibration is eliminated and wear on moving parts is prevented. Incredibly smooth surface finish and true rolling motion practically eliminate friction. And because Timken bearings permit tighter closures, maintenance and lubrication are cut to a minimum.

Timken bearings normally last the life of the machine because they are (1) engineered for the job, (2) made of Timken fine alloy steel, (3) precision manufactured.

Timken bearings are first choice throughout all industry. No other bearing can give you *all* the advantages you get with Timken bearings. Look for the trade-mark "Timken" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



Here's how **BARNES DRILL CO.** *uses Timken bearings in the travelling head of its No. 36 horizontal honing machine.*

DESIGN LEADERSHIP

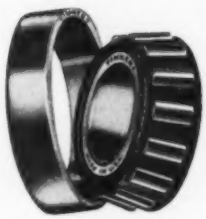
The first Timken tapered roller bearing was produced in 1898. Since then the one-piece multiple perforated cage, wide area contact between roll ends and ribs, and every other important tapered roller bearing improvement have been introduced by The Timken Roller Bearing Company.

The Timken Company leads in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ⬭ AND THRUST ⬭ LOADS OR ANY COMBINATION ⬭